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The Lizards of Thailand

BY

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ABSTRACT: The entire known lizard fauna of Thailand is treated, based for the most part on collections made in Thailand in 1957, 1958, 1960, 1961, by the author and now in the zoological collection of Chulalongkorn University, Bangkok, Thailand.

More than one hundred of the 116 species and subspecies described are illustrated by photographs in black and white.

The following new species are described:

Peropus angusticaudatus

Cnemaspis kumpoli.

A few forms are reported for the first time as occurring in Thailand.

THE LIZARD FAUNA OF THAILAND

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INTRODUCTION

The work involved in preparing this review of the herpetology of Thailand was undertaken at the specific request of Dr. Supachai Vanijuvadhana, Professor and Head, Department of Biology, and Secretary General of Chulalongkorn University, Bangkok, Thailand, who has himself long been interested in Thai faunas. Through the kind offices of Dr. Supachai, a Fulbright Grant was made available to me for the period, September, 1957, to June, 1958; and again from July, 1959, to September, 1960. In 1961 I again returned to the Far East and spent a number of months in Thailand and surrounding countries. Thus altogether nearly two and a third years were spent in the country, of which about one year and four months' time was spent in exploring and collecting either in Thailand or along boundaries of neighboring countries.

While no collector alone can hope to sample adequately the herpetological faunas of a country as large as Thailand* in so short a time, nevertheless, several thousand specimens were made available for study. These together with a study of collections in a number of European and American museums has served for the survey.

The plan of this work, as well as that on the serpents of Thailand and the turtles of Thailand (also ready) is largely that of the first volume on the Amphibia of Thailand† published in 1962. A great deal of field data and ecological observations has been omitted from the manuscript to allow for adequate illustrations. While the value of this field work is certainly not underestimated, it is recognized that this type of work can be done with greater ease and deliberation by Thai students when adequate means are available for identification of their materials.

I am most especially indebted to Dr. Supachai Vanijuvadhana who

* 225,148 square miles and extending from 6° to 21° N lat.; and from 97° to 106° E long.

† Univ. Kansas Science Bull., vol. 43, 1962, pp. 265-599, figs. 1-106.

initiated the work, and in every way possible was untiring with his help, and maintained prompt concern for my needs. He has my appreciation and gratitude.

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To all these I offer my sincerest gratitude.

THE LIZARD FAUNA OF THAILAND

The reptilian group Sauria, comprises all of the animals commonly called lizards and while most of them can be placed in this reptilian group by casual observations, there are many kinds that have lost arms, and legs, as well as the girdles for supporting these, and have become burrowing animals now having more the appearance of serpents than of lizards.

Even the lizards with their usual accouterments of limbs, scales, sense organs, etc., present considerable variety of shapes and sizes. Most of the differences in body-shape and character are interpreted as adaptations to environments. While most of these lizards are terrestrial in habit, many have become arboreal; some are glissant forms, gliding through the air; some have become largely aquatic, and as pointed out, some are subterranean.

Very often an examination of a lizard from an unknown locality will disclose by body-form its type of habitat. Thus the character of the toes and feet often show whether the animal is a good climber; an examination of the digital lamellae, whether they can cross ceilings, while a compressed body and long tail suggest that they are arboreal forest dwellers.

Locomotion: Locomotion among lizards is indeed varied. Those with arms and legs are able to move rapidly over the earth, or they may climb trees with ease. However some of the lizards with four limbs have developed the ability to move in bipedal fashion. This is true of certain Iguanids, some being capable of moving so rapidly that, with the use of their long tails, they are capable of running on the surface of a stream or pond of water and if not crossing it completely may move for a considerable distance upon its surface. One Agamid of Thailand, the "Yaă," *Leiolepis belliana*, when running at maximum speed often moves bipedally, but I have not seen the species attempt to cross water in this fashion.

Probably the development of the organs permitting the animal to glide through the air is the most striking adaptation for arboreal locomotion. In the Agamid dracos the ribs push out from the sides of the body carrying a fold of skin. The ribs can be moved and the skin-fold covering them can be spread out or folded back along the sides of the body. Presuming they wish to move from one tree to another, they loosen their hold on the tree and the moment they start to fall the wing is spread and the animal glides to the desired

goal. It can change its direction, avoid branches, and trees, and alight seemingly with all movement under control.

The loss of arms and legs requires the use of body muscles for locomotion, and the lizard in this condition moves much in the fashion of a snake or worm. Even some species whose limbs have become very short fold them closely along the sides of the body and move in a serpentine fashion.

Sex and reproduction: The usual expectation in any population is practically an equal number of males and females. For the most part this is the case. However in *Hemidactylus garnotii* males are rarely found throughout its range* and the same is true of *Lepidodactylus lugubris* and *L. divergens*.

All eggs are fertilized internally, the male being equipped with two separate intromittent organs which lie at the base of the tail posterior to the anus and are protruded through the cloacal opening. After fertilization the eggs may have a shell placed on them and they may be laid; or they may be retained in the uterus without a shell until the eggs are ready to hatch, the young then are born alive.

The egg coverings of most lizards are of a flexible leathery material which permits egress and ingress of water through the surface. Eggs of this kind are buried beneath the surface of the earth, presumably to prevent dessication. However, many of the gekkoes lay eggs with shells containing calcium, which makes the egg brittle. In such cases the eggs are placed in nooks and crannies or they are plastered together against a surface such as a rock, or the underside of leaves, or on a tree-trunk. Seemingly there is no water loss or gain. Most of the species hide the eggs in dark places; however, *Ptychozoon* may place the eggs on a smooth-barked tree where the egg is exposed to light and wind until it hatches. It appears that the female chooses a spot where the sun does not shine directly against them.

If the eggs are buried, the young when they hatch must burrow to the surface and escape. Young gekkoes may hatch in precarious places but the adaptation of their hands and feet is such that the lamellae adhere to the surface and the young usually emerge safely even from the underside of a leaf in a high tree.

The eggs vary much in size and shape. Some may be typically egg-shaped, rounded at one end and oval at the other while still

* One possible exception to this is *Hemidactylus garnotii* and *Lepidodactylus lugubris* on the island of Tinian. Dr. Fred R. Cagle studied the lizards there, collected many and sexed them all. No disproportion in the number of sexes is expressed and presumably not noticed. Unless one questions the identification of these lizards as reported by Dr. Cagle, one is forced to conclude that the genetic mechanism responsible for large female populations is not operable on Tinian.

others are spindle-shaped with a narrow point on each end of the egg; others somewhat elongate, rounded rather than oval at each end. Some of the Agamids of the genus *Draco* may have a small "shelf" pinched at one end of the egg. In burying the eggs, Agamids of the genus *Calotes* usually choose a rather solid area (such as a well-trampled elephant path) and dig with their hands a cuplike cavity into which the eggs are laid. The hole is refilled with earth and tamped by spreading the arms somewhat and using the head as a pile-driver! The head may strike the earth as many as a hundred times, leaving the surface above the eggs quite firm. The Ceylonese genus *Lyriocephalus* has developed a globular protuberance on the end of the snout in adults. I do not know whether this is used in pounding loose earth after egg-laying or not.

Glands: The characteristic glands of lizards are numerous. A large number of species have special glands in the scales of the head and these glands may likewise be distributed over most of the body. Dr. Giuseppe Scortecci, Istituto di Zoologia, University of Genoa has made a splendid study of these organs in the Agamidae.* A large number of genera in the families Gekkonidae, Agamidae, Lacertidae, Varanidae and Dibamidae have small organs, usually called preanal and/or femoral pores. These appear in the males and in some genera and species may also exist in the females, where they are usually smaller and often non-functional. However, the presence of these in the female is the rarer condition. In the Gekkonidae the pore-scales are usually in the same proportions and numbers but even this is not invariable. Just how these pores function is still a matter of conjecture. Some genera are such that males of certain species have femoral pores while other species lack them in both sexes. One remarkable fact seems to be that all endemic members of the family Gekkonidae in the Western Hemisphere lack the true femoral or preanal pores. In the family Eublepharidae they are present; while in the Sphaerodactylidae there is another type of organ (escutcheon scales) that occupy the same general area as the preanal and femoral pores do and one presumes they subserve the same function.

The preanal pores differ considerably in number but the usual arrangement is a continuous row on the underside of the femur meeting in the preanal region; or the femoral series may be separated from the preanal series. In some Australian and New Zealand forms there may be many series of pores and they may total more than a hundred.

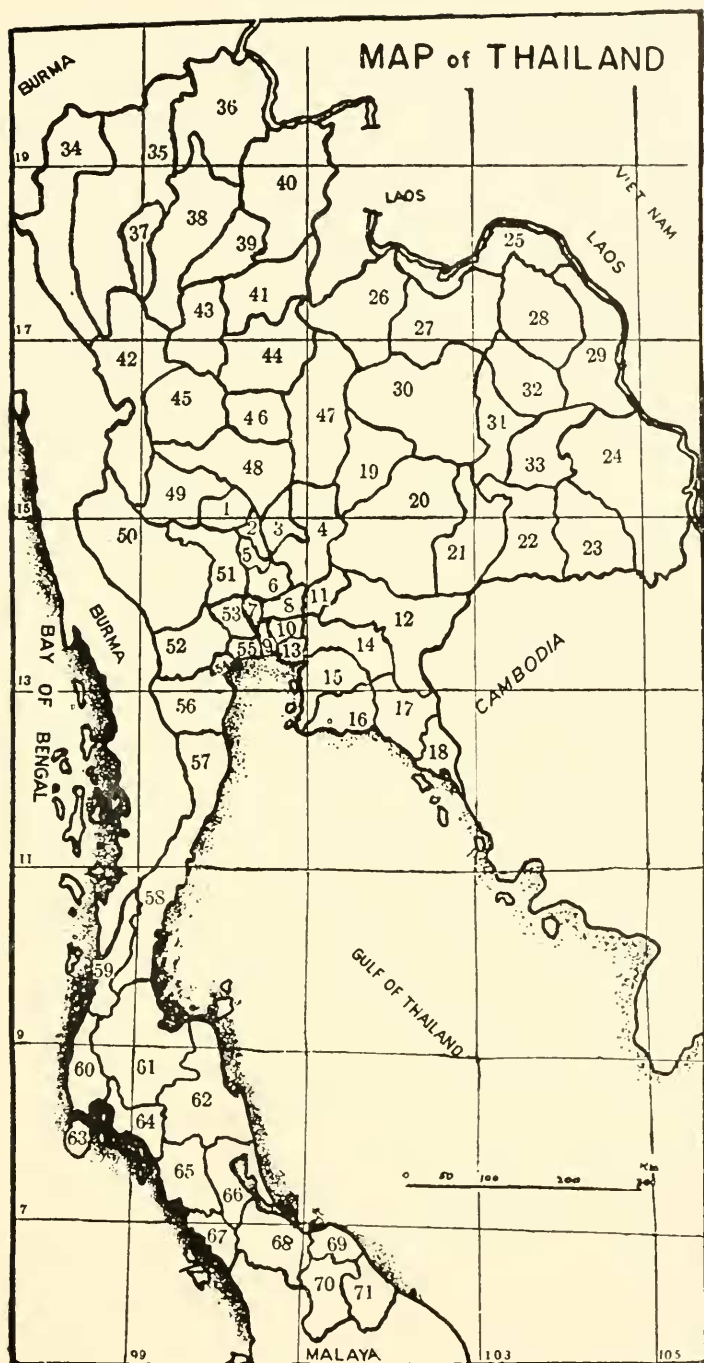
* Mem. Soc., Ital. Sci. Nat. (Mus. Civ. di Storia Nat. Milano), vol. 10, fasc. 3., 1941.

LIST OF THAI PROVINCES

(Corrected spellings as used by the U. S. Army Gazetteer, 1944)

- | | |
|--------------------------------|-------------------------|
| 1. Chainat | 37. Lamphun |
| 2. Sing Buri | 38. Lampang |
| 3. Lop Buri | 39. Phrae |
| 4. Sara Buri | 40. Nan |
| 5. Ang Thong | 41. Uttaradit |
| 6. Ayutthaya | 42. Tak |
| 7. Nonthaburi | 43. Sukhothai |
| 8. Pathum Thani | 44. Phitsanulok |
| 9. Thon Buri | 45. Kamphaeng Phet |
| 10. Phra Nakhon (Bangkok) | 46. Phichit |
| 11. Nakhon Nayok | 47. Phetchabun |
| 12. Prachin Buri | 48. Nakhon Sawan |
| 13. Samut Prakan | 49. Uthai Thani |
| 14. Chachoengsao | 50. Kanchanaburi |
| 15. Chon Buri | 51. Suphan Buri |
| 16. Rayong | 52. Rat Buri |
| 17. Chanthaburi | 53. Nakhon Pathom |
| 18. Trat | 54. Samut Songkhram |
| 19. Chaiyaphum | 55. Samut Sakhon |
| 20. Nakhon Ratchasima (Khorat) | 56. Phet Buri |
| 21. Buriram | 57. Prachuap Khiri Khan |
| 22. Surin | 58. Chumphon |
| 23. Khu Khan (Sisaket) | 59. Ranong |
| 24. Ubon | 60. Phangnga |
| 25. Nong Khai | 61. Surat Thani |
| 26. Loei | 62. Nakhon Si Thammarat |
| 27. Udon Thani | 63. Phuket |
| 28. Sakon Nakhon | 64. Krabi |
| 29. Nakhon Phanom | 65. Trang |
| 30. Khon Kaen | 66. Phatthalung |
| 31. Maha Sarakham | 67. Satun |
| 32. Kalasin | 68. Songkhla |
| 33. Roi Et | 69. Pattani |
| 34. Mae Hong Son | 70. Yala |
| 35. Chiang Mai | 71. Narathiwat |
| 36. Chiang Rai | |

As for the spelling of Thai names, I am using the scheme of transliteration from the Thai alphabet adopted by the Thai Government nearly two decades ago, and likewise used in the U. S. Army Gazetteer of 1944. This often is at variance with spellings encountered in European or older American maps, or in other reports. An effort should be made to stabilize the system of transliteration.



MAP 1.—Outline Map of Thailand, showing provinces (changwats).
The numbers have no significance of their own.

In certain *Cnemaspis* the pores are so minute that one may need a lens to be certain of their presence. This small size may account for reports of the absence of pores in males of certain species of this genus. While the preanal and femoral pores are absent from the Scincidae, I have recently noted a series of postanal pores in certain members of the genus *Tropidophorus*.

Poisons: Among oriental lizards not a single species is capable of transmitting a specific poison by biting and not one is known to be poisonous. The dracos have a pair of small caninelike teeth in both jaws and larger ones have sufficient jaw strength to penetrate the skin. The large gecko or Tokay is very likely to bite when being caught or held. Once when the jaws are clamped down on a finger or on a bit of skin the teeth may not penetrate the skin, but if the bitten part is withdrawn suddenly usually an area of the skin is scratched or injured leaving an unpleasant but not necessarily a serious wound.

Voice: The lizard species of the family Gekkonidae have a voice mechanism and are capable of making a sound of their own volition. The "*tokay*" has the loudest call and this is usually easily recognized and well known. The smaller domestic geckoes called *chinchook* also have a voice, and these sounds are easily recognized. It is not known whether the single representative of the Eublepharidae has a voice or not.

Occasionally other kinds of lizards are reported as having a call but this most probably is due to hearing a sound and seeing an animal at the same time without the certainty that the sound is produced by the animal. I have had a report that the flying dracos produce loud sounds but this is doubtless a case of uncertainty as to the source of a sound heard. These species certainly have no voices.

METHODS

The general plan of this work follows that of the Amphibians of Thailand, published in 1962. Since that work was completed the new International Rules of Nomenclature and Procedure has been published. In consequence in this work on the Saurians I have attempted to follow the proposed regulations such as the use of the colon after authors names in the listing of literature. The recording of type-localities where these are known for original names and synonyms.

The spelling of Thai geographic names has caused no small difficulty since the available maps show great diversity. This is because the Thai alphabet has many more characters available than the English and there is no consensus as to the proper spelling of the Thai word and certainly none for the proper method of transliteration into English. In reporting the distribution of the various species I have listed for the most part only the *Changwat* or province rather than publish the catalogue of all the specimens collected. This of course is a measure for economy. In the spelling of the province names I have used the spelling of the U. S. Army Gazetteer of 1944. Among the other geographic names, while I have attempted to follow the same criterion, many are not so transliterated. There are perhaps some inconsistencies in the spellings. One other difficulty has been the fact that the geographical divisions have themselves been changed. Thus formerly much of the present southern part of peninsular Thailand consisted of Pattani which was further divided into several smaller states. These have now ceased to exist and Pattani now consists of three Changwats, Pattani, Narathiwat and Yala.

The specimens in the collection largely brought together by me form the basis for this study, and all numbers unless otherwise designated belong to that collection. In a number of cases other specimens have been photographed or described and abbreviations have been used. These abbreviations are as follows:

AMNH	American Museum of Natural History, New York.
B.L.	Private collection of Dr. Boonsong Lekagul, Bangkok.
B.M.	British Museum (Natural History), London.
C.U.	Chulalongkorn University more recent acquisitions, Bangkok.
EHT-HMS	Edward H. Taylor-Hobart M. Smith Collection, Lawrence, Kansas.
NHMW	Museum, Vienna.
KUMNH	Kansas University Collection, Lawrence, Kansas.
M.S.	Malcolm Smith, private collection (chiefly in the British Museum).
N.P.K.	Private collection of Nai Prayoon Kananuracks, Na Pradoo Pattani.
USNM	United States National Museum, Washington, D. C.

TAXONOMIC CONSIDERATION OF ORDER SAURIA

KEY TO THE FAMILIES OF SAURIA

1. Diminutive, wormlike lizards with a single large plate covering most of snout; eyes covered; arms absent; legs present as two small flaps at sides of vent in males only; two or four preanal pores, scales uniform, cycloid, imbricate *Dibamidæ*
Lizards of various sizes, usually not with a single scale covering most of snout, or, if so, no sexual dimorphism in limbs 2
2. Very large lizards, one to three meters in length, covered with small tuberculate juxtaposed scales, each surrounded by a row of minute tubercles; tongue long, slender, deeply bifid, retractile into a sheath; always pentadactyl; an elongate tail; head with numerous small scales above *Varanidæ*
Smaller lizards, under one meter in length; tongue not as described above; without rows of minute tubercles surrounding scales; limbs may or may not be pentadactyl 3
3. Scales covering top and sides of head not enlarged or symmetrical ... 4
Scales covering top and sides of head enlarged, symmetrical, or if with small scales and tubercles, the teeth acrodont (*Agamidæ*) 5
4. Vertebrae procœlian; parietal bone single; eye with thick movable connivent eyelids; claws retractile *Eublepharidæ*
Vertebrae amphicoelian; parietal bone divided *Gekkonidæ*
5. Teeth acrodont, varying in shape and not replaced; tongue thick; femoral pores absent in Thai species (except in the genera *Leirolepis* and *Physignathus*) *Agamidæ*
6. Inguinal or femoral pores; back covered with large rhomboidal keeled shields forming longitudinal series; tail extremely long (Thai form) *Lacertidæ*
No femoral, preanal, or inguinal pores; body covered with cycloid imbricating scales above and below; tail usually about equal to snout-vent length, rarely twice as long; osteoderms often present; rarely postanal pores or glands *Scincidæ*

FAMILY EUBLEPHARIDÆ Boulenger

True eyelids present, without "spectacle"; pupil vertical; vertebrae procœlous; parietal bones united; digits straight, slender, without lamellae claws usually partly concealed or retractile; postanal sacs and bones present; body often compressed.

This family is represented sparingly in both Eastern and Western Hemispheres. Of the two Asiatic genera, *Eublepharis* and *Aeluroscalabotes*, only the latter has been taken within the confines of Thailand, this is in the southern part. However, the presence of two species in India and another in Hainan and one in the Riu Kius suggests that another species may occur in the northern part of Thailand if the generic distribution is not discontinuous.

Three species of *Aeluroscalabotes* have been described. These are strange-looking lizards with a head twice as wide as the neck

and wider than the body, which is more or less compressed. The tail is relatively short. The claws are retractile into sheaths, and true moveable eyelids are present.

Of the genus *Eublepharis* one species is found in northwestern India, and one on the island Hainan. One presumes that the distribution is discontinuous.

Aeluroscalabotes Boulenger

Aelurosaurus (non Owen) Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 73 (*felinus* type of genus).

Aeluroscalabotes Boulenger, *ibid.*, vol. 3, 1887, p. 482.

Diagnosis: Digits short, sub-cylindrical at base, compressed, in distal phalanges, which are raised and furnished with a claw that is retractile between the three plates forming a compressed terminal sheath; transverse thickened lamellae at base of underside of digits; distal scales small, numerous; body with small nearly uniform juxtaposed flat scales; upper and lower eyelids well developed; pupil vertical. Males with preanal pores.

Only a single species is recognized in Thailand and Malaya. Two others, however, have been described.

Aeluroscalabotes felinus (Günther)

FIG. 1

Pentadactylus felinus Günther, Reptiles of British India, 1864, p. 117, pl. 12, fig. F (type-locality, Singapore).

Aelurosaurus felinus: Boulenger, Catalogue of the lizards in the British Museum, Ed. 2, vol. 1, 1885, p. 73, pl. 3, fig. 8.

Aeluroscalabotes felinus: Boulenger, Catalogue of the lizards in the British Museum, Ed. 2, vol. 3, 1887, p. 482; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore including the adjacent islands; Reptilia and Batrachia, 1912, pp. 39-40; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 6, no. 3, July 1924, p. 317 ("Patani").

Diagnosis: (see generic description).

Description of species (from EHT-HMS No. 3168; Selangor, Malaya, 1961): Head strongly triangular, more than double width of neck. Body and neck strongly compressed; tail shorter than body, also somewhat compressed; rostral large, more than twice as wide as high, bordered behind by two large supralabials, two nasals and three other enlarged scales; behind these scales a group of twelve large scales arranged in two irregular rows; nostril surrounded by one nasal, which seems to surround nostril completely; bordering this rim is a small "supranasal," the first labial, and four or five small scales; eye length (7 mm.) equal or slightly less than its distance to nostril; a slight depression behind nostril; a depression in frontal



FIG. 1.—*Aeluroscalabotes felinus* Günther, EHT-HMS, No. 3168, Selangor, Malaya. Actual length, 186 mm.

and interorbital areas; auricular opening largely below level of corner of mouth, its distance from eye, nine millimeters, its diameter, 1.3 millimeters; eye with a vertical pupil; upper and lower eyelids rather well developed; supralabials, 12-13, last small; mental with a labial border nearly equal to that of rostral, followed by two somewhat irregular chinshields; twelve infralabials, last large; a row of much-enlarged scales on each side of lower jaw bordering infralabials, anteriorly touching chinshields.

Scales on dorsal part of head small, nearly uniform, juxtaposed, biscuit-shaped, somewhat elevated, their surface granular or corrugated seen under a lens; scales on side of snout distinctly smaller, granular, those on body slightly larger than on head, those on venter slightly larger than on dorsum; an angular series of 25 enlarged scales of which median ten are perforated or with small pits; caudal scales nearly smooth, a little larger than body scales, forming perfectly straight transverse rows around tail.

Limbs slender, tip of each digit provided with an enlarged sheath composed of a small dorsal and two large lateral scales into which claw is retracted; fingers short, subcylindrical at base with thickened transverse lamellae, the series on various fingers cross palm; distal part of fingers with five to seven rows of fine scales instead of lamellae; the lamellae on toes continuous across sole; distally toes have rows of from three to five scales; when arm and leg are laid along body they overlap about twelve millimeters.

Color: Dorsal and lateral parts of head and body uniform brown with two lines of dim tan spots beginning on occiput, continuing on dorsum to base of tail; lower surfaces of head and venter cream, dotted with brown; upper lip, chin, and throat cream; tail brown, on dorsal surface of a somewhat darker shade and with four cream

Measurements in mm. of *Aeluroscalabotes felinus*

NUMBER	M. 140	No. 3168	M. 141
Snout to vent	106	112	76
Tail length	80	71	?
Total length	186	186	?
Width of head	20	19	13
Length of head	25.5	25.5	19
Tip of snout to arm	39	42	32
Axilla to groin	55	58	36.5
Arm	34	32	23
Leg	41.5	42.5	30

All from near Kuala Lumpur, Selangor, Malaya.

spots, with dark brown borders on their basal third; on subcaudal region several cream spots usually associated with dark-brown spots or flecks; distal part of tail uniform brown.

Variation: The sides of the head are often considerably darker than the top. Occasionally the color is quite different. Boulenger (1912) states: "Brown above, with two dorsal series of more or less distinct lighter, dark-edged roundish spots; sometimes scattered white dots on the sides of the body." There are 12 small preanal pores on No. 141 and one or two adjoining scales have pits; the outer scales of the series stand nearly erect tending to overlap the next outer scale.

The posterior edge of the pupil is smooth, the anterior crenellated. Two strong lateral tubercles are present on sides of base of tail, the area about them being cream. There is no web or only the faintest trace of a web between digits.

Distribution: A single specimen of this species has been taken in Thailand. It was captured at "Benang Star," Yala province (formerly in Pattani province).

Outside of Thailand the species has been reported from Singapore (the type locality) and the Larut Hills, in Perak, Malaya. It has also been reported from Borneo.

Remarks: Concerning the two other species described in this genus, *A. dorsalis* and *A. longicauda*, Dr. Malcolm Smith (1930) states: "I strongly doubt if *A. dorsalis* Peters, 1872, and *A. longicauda* Anderson, 1924, should be regarded as distinct; the characters on which they are based seem to be varietal, rather than specific." This matter should be reinvestigated since Dr. Smith has left much room for doubt.

The specimen described was captured at night on a plant growing out of the water of a small stream. It was not especially active. In the laboratory at Kuala Lumpur it was kept in a small cage in which was placed a dish of water. The animal, a gravid female, entered the water and remained partially submerged for several days until it was preserved.

FAMILY GEKKONIDAE Gray

The proper limits of the Family Gekkonidae have been in doubt for some time. G. A. Boulenger in the British Museum Catalogues recognized three families of gekkolike lizards: the Eublepharidae, Uroplatidae, and the Gekkonidae proper. Certain recent taxonomists have found and defined a fourth group, the Sphaerodactylidae,

seemingly worthy of family recognition, a group confined to the Western Hemisphere.

One sees in these four families, relationships that suggest that they are members of the same superfamily. It is believed that the interest of taxonomy is best served by recognizing these groups as family groups. Only two of these are Asiatic, the Gekkonidae, and the Eublepharidae, and each likewise has representatives in the Western Hemisphere.

The best known representatives of the Gekkonidae are the small, domestic species living in houses and other buildings as well as in original forest. The Thai name applied to several small species is "chinchook," and to a large domestic species of the gecko, *to-kay*. Certain of the species that live on the ground or trees are seldom seen or if seen, are not recognized as different from the domestic forms.

There are nine genera of the Gekkonidae known in Thailand. These are *Cyrtodactylus* (formerly *Gymnodactylus*), *Cnemaspis*, *Hemidactylus*, *Peropus*, *Platyurus*, *Hemiphyllodactylus*, *Gekko*, *Phyllodactylus*, and *Ptychozoon*. These will be treated later.

General Characteristics of the GEKKONIDAE

The Thai species of this family may usually be recognized by having the dorsal and lateral part of the body covered with soft granules or scales often intermixed with larger tubercles. In *Phyllodactylus* these enlarged tubercles, usually trihedral, almost cover the dorsum. The ventral surface of the body usually is covered by cycloid scales. Males of many of the species have small "glandular" pores in scales situated somewhat anterior to the vent (preanal pores) and others may have a longer or shorter series along the underside of the thigh (femoral pores); these may be continuous with the preanal series. These pores are usually present in males and rarely tiny pores may be discovered in the females of certain species (*Cyrtodactylus*) but seemingly they are not functional. The numbers of pores are variable, reduced to one or two on each side (*Cnemaspis*) or there may be sixty or eighty forming a large cluster as in *Rhacodactylus*. The purpose served by femoral and preanal pores has not been learned.

Many of the genera have specialized structures on the digits that enable them to run or crawl about a ceiling or wall as easily as on a floor. These consist of widened overlapping lamellae which have very fine papillate processes, the purpose being to cause adhesion

to a smooth surface; these are evident only in arboreal species (or those secondarily adapted to human dwellings or rocks). The claws are not lost (or at most only one from a hand or foot) and these are of service when the animal has to crawl over a surface that is too rough or uneven for the adhesive pads to be serviceable. These lamellae may be arranged in a single row, may be in double rows, or may form rosettes near the tip of the digit. *Cnemaspis* and *Cyrtodactylus* are exceptions that cannot climb on nor cross smooth ceilings. The Thai species of *Phyllodactylus* living on the ground have a pair of widened lamellae near the tips of the digits, but I have not observed that these lizards are as adept at climbing as species of New World *Phyllodactylus* are capable of doing. Adhesive lamellae are absent in the genera *Cnemaspis* and *Cyrtodactylus*.* However, several such species are capable of climbing in tree trunks, some seemingly typically arboreal in habit, often feeding under bark of dead trees.

In the Gekkonidae, just posterior to the anus there are two small sacs opening to the outside. Partly within each sac in the males and lying below the skin is a small curved postanal bone. The sacs but no bones are present in females. These curious structures are present also in the family Eublepharidae, but absent in the family Sphaerodactylidae. There is no secretion from the sacs and their function is not clearly known.

A single Oriental genus (*Pristurus*, *fide* M. Smith) occurring in India is said to lack the postanal sacs and bones. I have not examined a representative of this genus, but at present it is usually placed in the family Gekkonidae.

Tails of species of this family are fragile and easily lost or broken. When broken they wiggle and twist serving often to attract the attention of a predator from the animal itself. The tail, when lost, except in rare cases, is grown again. This reproduced part contains cartilage but no bones and the tail rarely has the same external characteristics as the original tail, but it will usually reach the length of the original. Usually, if not always, the subcaudal scales are much wider than those of the original tail, and the dorsal and lateral tubercles and scales themselves may be different. One can, with care, invariably distinguish the reproduced tail from the original.

Members of the Family Gekkonidae and the Eublepharidae are the only lizards with a voice mechanism; most other lizards are silent. Some others may make a slight hissing sound but this is rarely

* Formerly regarded as *Gymnodactylus*.

the case; if the air is forcibly extruded from the lungs, a slight squeak may sometimes be produced.

KEY TO THAI GENERA OF THE GEKKONIDAE

1. Digits slender lacking adhesive lamellae 2
 Digits at least partly widened with at least some adhesive lamellae 3
2. Pupil round *Cnemaspis*
 Pupil a vertical slit; or when further closed appears as a vertical series
 of small openings *Cyrtodactylus*
3. A single terminal pair of widened lamellae between which the claw
 is retractile *Phyllodactylus*
 More than a single pair of adhesive lamellae 4
4. Tail strongly lobulate laterally, sometimes widened at tip; a lateral
 winglike expansion on each side of body and head *Ptychozoon*
 Tail not lobulate; a lateral fringe of skin present on side of body
 or not 5
5. A fringe of skin from axilla to groin; tail with a denticulate fringe,
 Platyurus
 No skin-fringe along side of body 6
6. Subdigital lamellae undivided; terminal joints of outer digits united
 with expanded part of digit; inner digit clawless *Gekko*
 Terminal joints of digits not united with the widened lamellae; sub-
 digital lamellae divided 7
7. Inner digit well developed 8
 Inner digit vestigial, without free terminal joint, clawless or with a
 minute claw; subdigital lamellae divided or single,
 Hemiphyllodactylus
8. Inner digit well developed, without free terminal joint, the claw
 minute, often concealed *Peropus*
 Inner digit well developed, with a free, clawed terminal joint,
 Hemidactylus

GENUS CYRTODACTYLUS Gray

Cyrtodactylus Gray, Phil. Mag., vol. 2, 1827, p. 55 (type of the genus *Cyrtodactylus pulchellus* Gray).

Diagnosis: All digits slender with claws surrounded by two scales, lower very large, notched below claw; upper scale small; distal phalanges usually compressed making an angle with proximal part of digit, which is flattened, with short series of enlarged flat plates or lamellae, contiguous or imbricate; subcaudal scales enlarged, either paired, or median series transversely widened; pre-anal or femoral pores (sometimes both) present. (One specimen of *oldhami* reported in which only one pore is present, another with none [*fide* Malcolm Smith]); scales of females have "impressions" but are not or but rarely perforated; median postmentals form a common suture behind mental; generally three or more scalerows on sides of digits; pupil vertical tending to form tiny openings when not dilated (*Gekko*-type pupil).

The genus *Cyrtodactylus* has been revived by Garth Underwood for species occurring outside the Western Hemisphere formerly placed in the genus *Gymnodactylus*. This latter name is restricted to South American species, a group, none of which has preanal or femoral pores. Most if not all of the species known in the old world have pores (see *oldhami*). The structure of the "eyelids" is different in *Gymnodactylus* and *Cyrtodactylus*.

There are, within the boundaries of Thailand, at least nine forms of this genus. At the tin mine (Tonka Harbour Tin Dredging Co., Rompilun) I obtained a specimen of what may have been another species, presumably undescribed. It was golden yellow in general color with some brown markings, but it escaped from a plastic bag, the only container available at that time, by the simple expedient of tearing a slit in it with a claw. No others were encountered. It was found ensconced under moss-grown, rotting bark, on a large stump.

The specimens are seen in the daytime only when they have been routed from hiding places; none has been seen in Thailand moving about of its free will in the daytime. Several species have been found roving at night and captured, while others were seen that escaped capture. I presume that in general they are nocturnal. The character of the lamellae under the toes does not permit them to move over a smooth ceiling as many geckoes do. Their strong claws, however, enable them to climb well on tree trunks or in caves. Certain species are more terrestrial than arboreal and occupy places on or under fallen logs or fallen bark. Two eggs are laid, but I have not discovered where they are placed.

Taylor and Elbel (Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, p. 1041) include *consobrinoides* Annandale in their list of species occurring in the Thailand fauna. This is an error, resulting from a misidentification, no specimens having been taken. It has, however, been taken at Tavoy, Tenasserim, Burma, about thirty miles from the Thai border, and very likely occurs in peninsular Thailand in the Bilauk Taung border range.

KEY TO SPECIES OF CYRTODACTYLUS IN THAILAND

1. Foot partially webbed; tail with lateral denticulations; nine preanal pores on either side; brown with W-shaped dorsal marks in young which may disappear in adults *brevipalmatus*
- No web present on hand or foot 2
2. Preanal and femoral pores present 3
- Only preanal pores present (rarely absent in *oldhami*) 4

3. Preanal pores 12-13, forming a Λ -shaped series enclosing a groove; femoral pores four to six on each side, widely separated from pre-anal series; no dark, light-edged band from eye around occipital region *marmoratus*
 Preanal pores eight, in two parallel rows lying in a deep groove but contiguous, at right angles, with a long series of femoral pores; a curved or angular, light-edged band from eye around back of occiput; body with transverse, light-edged, dark bands ... *pulchellus*
4. No median continuous series of transversely widened subcaudal scales 5
 A median series of transversely widened subcaudals in a continuous series except on basal 24 millimeters of tail 6
5. The median series usually paired or rarely with occasionally fused scales; male with preanal pores in an angular series of scales sometimes not strongly developed; a series of somewhat specialized femoral scales, without pores; four somewhat W-shaped marks of brown or black on dorsum *angularis*
 No dark band passing from eye to eye behind occiput; body with four or three longitudinal stripes originating behind eye... *quadrivirgatus*
6. Male with one or two preanal pores on each side (rarely absent); brown or dark brown with whitish elongate or rounded spots tending to form longitudinal rows on dorsum; curved dark light-edged band from eye around occiput *oldhami*
 Male with five or more preanal pores 7
7. Male with seven or eight preanal pores; paired median series of dark spots and a lateral series of transversely widened dark spots (often tending to fuse) all in a reticulum of cream-white; head with a white reticulum enclosing dark spots *peguensis peguensis*
 Body marked with transverse bands (sometimes broken) 8
8. Body banded with seven transverse dark-edged bands, separated by narrow gray interspaces; top of head with a light reticulum enclosing darker spots; eight or nine preanal pores, *peguensis zebraicus*
 Body gray or gray-brown marked with four distinct bands of dark brown or blackish brown each edged with yellow or cream; a light-edged brown band from eye around occiput; top of head uniform brownish; preanal pores eight to ten; venter with 40-50 rows of scales at middle of body *intermedius*

Cyrtodactylus brevipalmatus (M. Smith)

FIGS. 2, 2a

Gymnodactylus brevipalmatus M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 6, 1923, p. 48, pl. 5, fig. 1 (type-locality, Khao Luang, Nakhon Si Thammarat Mts., Peninsular Siam); Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 55 ("Hills near Raheng, Ban Pa Che, northern Siam.").

Diagnosis: A medium-small species (greatest length known, 72 mm. snout to vent); ear-opening one sixth of eye diameter; about 44 scales across venter between the ventrolateral folds; folds bearing

enlarged tubercular scales; nine very large preanal pores, six-seven femoral pores; no pubic groove; toes with webs at base. Brown above, with or without indistinct spots.

Description of species (data from type-description): Head moderately depressed, snout little longer than orbit; ear-opening small,

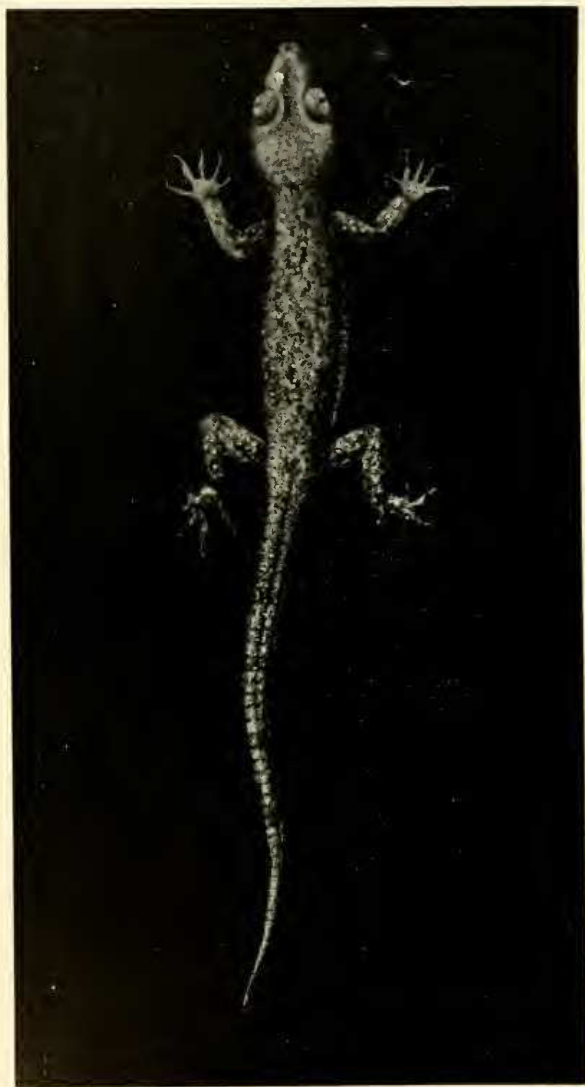


FIG. 2. — *Cyrtodactylus brevipalmatus* M. Smith.
Fig. after M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 6
1923, pl. 5, fig. 1. Khao Luang, Nakhon Si Thammarat,
Mts., Thailand.

oval, one sixth of diameter of eye; head covered with small granules, largest over snout, those on occiput intermixed with small tubercles; rostral quadrangular, broader than high, bordering nostril first labial, two supranasals, and two small internasals; an entrant suture from top edge, bifurcating, its branches continuing somewhat, forming an angle greater than a right angle; supralabials, 12-13, first bordering nostril; infralabials, 10-11; mental large, subtriangular; first pair of chinshields large in contact with each other followed by two pairs of smaller scales, these widely separated. Throat and chin covered with small flat granular scales; dorsum with fine granules

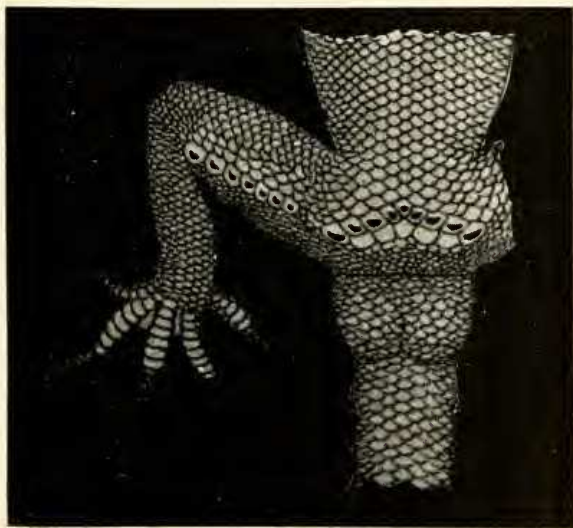


FIG. 2a.—*Cyrtodactylus brevipalmatus* (M. Smith).
From M. Smith, Journ. Nat. Hist. Soc. Siam. vol. 6,
1923, pl. 5, fig. 1 (part.)

interspersed with enlarged rounded keeled tubercles; indistinct ventrolateral folds with enlarged scales, separated on venter by about 44 rows of small cycloid scales. A series of nine much enlarged preanal pores forming wide angle; six and seven femoral pores separated by an interval from preanal series; enlarged scales preceding and following pore-scales; no pubic groove.

Tail cylindrical, tapering, covered with small scales and regularly disposed rows of keeled tubercles above, with irregularly disposed enlarged scales below. Limbs moderate, digits long, toes webbed at base and strongly compressed distally. Basal part of digits with six or seven broad imbricate transverse plates below.

Color: Brown above with obscure darker mottlings; much paler below.

Measurements in mm. (Type, No. 6367, and a topotypic paratype No. 6366): Snout-vent length, 64, 72; tail, 77, ?; arm, 19, 23; leg, 30, 35.

Remarks: The types were collected on Khao Luang at an altitude of 750 meters in the Nakhon Si Thammarat mountains in the province of this name, by H. M. Pendlebury, Esq., in March, 1922. This species has not been obtained since. The second specimen, No. 6366, is a female; there are 35 scales across the venter. The ventrolateral fold is distinct. The specimen is brown above with small irregularly disposed black spots. The venter and throat are also faintly spotted.

The presence of a small web between the toes will separate this form from other Thai members of the genus. The arrangements of the femoral and preanal pores differ from the other local species. Both type and paratype were found on trees hiding under dead bark.

Cyrtodactylus marmoratus (Kuhl)

Phyllurus marmoratus Kuhl, in Fitzinger, Neue klassifikation der Reptilien nach ihrem natürlichen Verwandtschaften, 1826, p. 47 (type locality, Java).

Cyrtodactylus marmoratus: (part.) Gray, Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 173.

Gonyodactylus marmoratus: Gray, in Griffith's Cuvier's Animal Kingdom, vol. 9, Synopsis, 1831, p. 51; Girard, U. S. exploring expedition, vol. 20, herpetology, 1858, p. 304.

Gymnodactylus marmoratus: Duméril and Bibron, *Erpétologie générale* . . . vol. 3, 1836, pp. 426-428, plate 34, figs. 1, 1a; Schlegel, *Abbildungen neuer oder unvollständig bekannter Amphibien* . . . 1837, p. 8, 1837, pl. 2; Steindachner, *Reise der oesterreichischen Fregatte Novara um die Erde in den Jahren, 1857-1858-1859*, Wien, 1867, p. 17; Boulenger, *Catalogue of the lizards in the British Museum*, 2nd Ed., vol. 1, 1885, pp. 44-45; Flower, *Proc. Zool. Soc. London*, 1899, p. 626; Laidlaw, *Proc. Zool. Soc. London*, vol. 1, 1901, p. 304; Boulenger, *Fasciculi Malayenses*, *Zoology*, vol. 1, 1903, p. 148; *A vertebrate fauna of the Malay Peninsula* . . . Reptilia and Batrachia, 1912, pp. 35-36; M. Smith, *Journ. Nat. Hist. Soc. Siam*, vol. 1, no. 3, p. 153 (Sai Yoke district, Kanchanaburi province); *ibid.*, vol. 2, 1916, p. 151 ("Bangnara and Patani"); *ibid.*, June, 1916, p. 61; *Journ. Federated Malay States Mus.*, vol. 10, 1922, p. 268; Kopstein, *Treubia*, *Buitenzorg*, vol. 11, 1930, p. 304; *Bull. Raffles Mus.*, no. 10, 1935, p. 62; *ibid.*, no. 14, 1938, pp. 137-138; ? Gibson-Hill, *Bull. Raffles Mus.*, Singapore, no. 18, 1947, pp. 81-86 (Christmas Island); Brongersma, *Versl. gewone Vergad. Akad. Amsterdam*, vol. 62, no. 10, 1953, pp. 172-175.

Diagnosis: Ear-opening one third of diameter of eye; median cleft in rostral; slight ventrolateral fold bearing row of tubercles from axilla to groin. Males with 12-13 preanal and 4-6 femoral pores; tail with uniform flat scales without enlarged tubercles; light brown above with chestnut-brown spots, sometimes confluent into cross-bands on back; tail with brown annuli.

Description of species (from Boulenger, 1885): Head rather large, depressed, oviform, snout longer than distance between ear-opening and eye; forehead with depression; ear-opening suboval, oblique, not quite one third diameter of eye. Body and limbs rather elongate. Digits strong, slightly depressed at base, strongly compressed distally; basal phalanx with well-developed transverse plates inferiorly. Head granular, with very small tubercles on occipital and temporal regions, granules on snout rather enlarged; rostral subquadrangular, not twice as broad as high, with median suture entering from above; rostral borders nostril, first labials, supranasals, and internasal scales; ten to twelve supralabials; nine to ten infralabials; mental triangular; two or three pairs of chinshields, median largest, in contact behind point of mental; throat minutely granulate; body and limbs covered above with small granules intermixed with small roundish, feebly keeled, subtriangular tubercles; a more- or less-defined series of tubercles from axilla to groin tending to form a ventrolateral fold delimiting venter; ventral scales small, cycloid, imbricate.

Males with twelve to thirteen preanal pores in a Δ -shaped series enclosing a groove; a row of four to six femoral pores widely separated from preanal pores. Tail cylindrical, tapering, covered with uniform small flat scales above, with a few scattered tubercles.

Color: Light brown above with chestnut brown spots, which are sometimes confluent into cross-bands on back; tail, when intact, with dark-brown annuli; chestnut-brown streak on side of head, passing through eye; lower surfaces brownish.

Measurements in mm.: Snout to vent, 76; tail, 72; total length, 148; width of head, 15; length of head, 21; arm, 26; leg, 34.

Distribution: The species has been reported in Thailand from "Bangnara, Patani" [= Narathiwat, Narathiwat province] and Bukit Besar, Pattani. There are a number of records for the species in Malaya. In the Indonesian region it has been reported from Sumatra, Java, and Celebes.

Remarks: There is seemingly an unrecognized species of this genus occurring in Sumatra and Java. It bears a resemblance to *marmoratus* but the pubic groove of the male contains one very large plate perforated by a single huge pore. The scales on each side of the groove lack pores, and the extended series as it reaches the femora may have small pores, very tiny perforations, or merely pits, or the scales may be smooth. Some specimens seen have the head spotted somewhat after the manner of *peguensis*.

There is a specimen in the British Museum (BM 63.12.11.173, RR 1946.9.7.44) which may be a specimen of a species identified as *Gymnodactylus agamensis* Bleeker in the Vienna Museum. It has a large pore in a single plate in a pubic groove. I have not found the original description of this species since the name (if the species name appearing on certain museum specimens was actually published) has been overlooked by subsequent workers. Spots on the body of the specimen tend to form more or less distinct transverse rows. The proximal part of the tail has tubercles on each segment, the distal part being strongly banded in dark brown and cream. There are about 18 rows of fine scales between the pore-scales and the vent.

A specimen of "*marmoratus*" from Bukit Besar, Pattani, Thailand, is a female and the characters of the pores are wanting, however, between the pores-scales and the vent there are seven rows of enlarged preanal scales. The rostral is bordered behind by five scales.

A form also occurs in Java, having a median plate bearing a large pore, and the femoral pores are a little better developed than in Sumatra specimens examined.

A review of these forms must be undertaken when material is available.

Cyrtodactylus pulchellus Gray

FIG. 3

Cyrtodactylus pulchellus Gray, Zool. Journ., vol. 3, 1828, p. 224 (type-locality, Singapore); Illustrations of Indian Zoology, vol. 2, 1834, pl. 74; Gray, Synopsis reptilium, in Griffiths' Cuvier's Animal kingdom, vol. 9, 1831, p. 51; Catalogue of the lizards in the British Museum, 1845, p. 173.

Gonyodactylus pulchellum: Wagler, Natürliches System der Amphibien, 1830, p. 144.

Gymnodactylus pulchellus: Duméril and Bibron, Erpétologie Générale . . . , vol. 3, 1836, pp. 423-425, pl. 33, fig. 7, 7a, 7b ("Cette belle espèce de Gymnodactyle est originaire du Bengale"); Günther, Reptiles of British India, 1864, p. 113; Cantor, Catalogue of Malay Reptiles, 1847, p. 25, reprint from Journ. Asiat. Soc. Bengal, vol. 16; Stoliczka, Journ. Asiat. Soc. Bengal, vol. 42, 1873, p. 118; Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 46-47; The fauna of British India, Ceylon and Burma; Reptilia and Batrachia, 1890, pp. 69-70; Flower, Proc. Zool. Soc. London, 1896, p. 863; *ibid.*, 1899, pp. 626-627 (Penang Hill 2000-2400; Larut Hills, 3400-4400 ft.); Fasciculi Malayenses Zool., vol. 1, 1903, p. 148; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, pp. 36-37; Annandale, Rec. Indian Mus., vol. 9, 1913, p. 325; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, Dec. 1916, p. 150 ("Khao Wang Hip, Nakon Sritamarat," Thailand); Mertens, Blätt. Aquar.-Ter. Jahr, 40, Heft No. 6, 1929, pp. 101-102, pl. 16, fig. 2; M. Smith, Bull. Raffles Mus., Singapore, no. 3, April 1930, p. 13.

Diagnosis: A large species reaching 115 mm. snout to vent; tail 144 mm.; body and tail banded dorsally and laterally with dark and



FIG. 3.—*Cyrtodactylus pulchellus* Gray. No. 35747, Khao Chong, Trang, Thailand. Actual length, 229 mm.

light bands. Top of head uniform gray-tan; preanal pores in two closely approximated longitudinal series in a deep groove, forming a right angle and continuous with series of from 15 to 20 femoral pores; subcaudals much enlarged, transversely widened, three fourths or more of the tail width.

Description of species (from No. 35747, Khao Chong Forest Station, Trang province, Thailand): Rostral large, (3 x 5.2 mm.), nearly erect, bordering nostril, first supralabial, two supranasals and an internasal; a median suture enters scale above, runs down for nearly one millimeter then bifurcates, the branches continuing for .8 millimeter; nostril surrounded by first supralabial, two postnasals, a supranasal, and rostral; neither of the postnasals seem to be fused to valvelike flap within nostrils; internasal nearly as large as supranasal; about 43 scales in a row across snout at back level of second supralabial; about 68 scales in a row across snout between seventh supralabials; about 70 scales across head between palpebral scales at middle of eyelid; length of snout (12 mm.) greater than distance between ear-opening and orbit (10 mm.); area posterior to nostril depressed; depressed area beginning on occiput continues forward between orbits widening and terminating in a sharp angle on snout; granules on snout variable in size, largest immediately following supranasal and internasal; next largest bordering supralabial and in the region anterior to upper part of eye; median and anterior occipital scales small, granular, intermixed with conical tubercles smaller than those on posterior part, which in turn are smaller than dorsal body tubercles; supralabials, 13-14, diminishing in size posteriorly, their surfaces rough, tubercular, and followed to mouth-angle by 12 undifferentiated scales; infralabials, 12-12, eighth on left side (ninth on right) split longitudinally; following infralabials to mouth-angle are eight to nine undifferentiated small scales; mental narrowed and pointed posteriorly, its labial border equal to that of rostral; pair of chinshields posterior to mental forming common suture for about one fourth of their length, about 2.5 times as long as wide; second pair of chinshields half as long as first pair, and separated by first pair; the two pairs bordered behind by four small scales; two or three rows of sublabials, somewhat enlarged; granules in a row on chin and throat, from chinshields to line drawn between front of shoulders, approximately 103; from front of shoulder to vent approximately 82; scales on dorsum, small, pavementlike, uniform, intermixed with about 24 irregular rows of trihedral or pyramidal (rarely conical) tubercles somewhat variable in size; scales

on tail in transverse rows, nine to eleven on each segment, last two rows with six or four enlarged tubercles, or more posteriorly with only two tubercles; hemipenes causing pair of strong postanal swellings; subcaudals greatly enlarged, three fourths to four fifths of width of tail, two belonging to each segment; approximately 79 subcaudals, terminal 28 millimeters of tail regenerated; regenerated scales not much widened, and not resembling those preceding; on each side of subcaudal row a series of somewhat widened scales larger than adjoining caudal scales. Dorsal part of arms, except elbows, legs, except knees, with numerous enlarged tubercles, those on legs largest; pair of distinct ventrolateral folds separated from each other by about 35 scalerows; those in median area largest, mostly cycloid, imbricating; eight preanal pores in deep longitudinal groove in preanal region forming two longitudinal rows of four and continuous at right angles with a long series of 14-15 femoral pores, which occupy scales of an enlarged series on underside of thigh.

Digits with flat imbricating somewhat widened lamellae on basal part; seven or eight on longest finger, eleven on longest toe; the distal joints crooked; penultimate joints arising from following phalanx, curving forward to tip with 13 or 14 compressed lamellae under longest finger and fourteen under longest toe; claw surrounded by two scales, lower widened on both sides and narrowed below, upper scale small; no web present.

Ear-opening small, vertical diameter about two millimeters with a slight fold above and below partly hiding opening, about one fourth of diameter of orbit (8.7 mm.).

Color in life: Head nearly uniform tan without spots; dark brown band begins behind eye and passes around occiput, widening on dorsal part of neck, bordered anteriorly and posteriorly by narrow line of cream bearing numerous cream-colored tubercles; on body four cream-edged transverse bands (third bifurcating on right side); tail with 7 + bands of dark brown to blackish, not passing across ventral surface of tail.

Chin and venter cream-white, subcaudal region for most of its length lavender to violet; labials gray-white; sides of snout a little darker than dorsal part.

Measurements in mm.: Snout to vent, 102; tail, tip regenerated, 127; total length, 229; snout to arm-insertion, 40.5; axilla to groin, 45; width of head, 23.6; length of head, 32; arm, 34; leg, 50.5.

Remarks: A single specimen was captured May 18, 1957, at Khao

Chong Forest Station from the trunk of a forest tree, near a small stream, late at night. A second specimen was seen in the nearby resthouse where I stayed, running along the floor to a small opening and escaping under the house floor; on a second visit another specimen was found in a crevice in a tree.

Variation: Flower (1899) regarded the species as living chiefly on rocks and in caves in Malaya but it is obvious that it is not confined to such habitats. He reports a male specimen having a snout-to-vent measurement of 115 mm.; tail, 144 mm. There were 36 femoro-preanal pores altogether in the specimen.

Distribution: In Thailand the species is known from Phattalung, Trang, and Nakhon Si Thammarat provinces.

The species was described as early as 1828 by J. E. Gray, whose type-specimens came from Singapore. It is known from numerous localities in Malaya and up to elevations of 3400-4400 ft. in the Larut Hills of Perak. It has also been taken in Bengal; and Tenasserim, in Burma.

Cyrtodactylus angularis (M. Smith)

FIG. 4

Gymnodactylus peguensis angularis M. Smith, Proc. Zool. Soc., London, 1921, no. 19, p. 427, text fig. 1A (on p. 28), (type-locality Dong Paya Fai Mountains, [not Dong Rek as originally stated, in error]).

Gymnodactylus angularis: M. Smith, Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2; Sauria; Feb. 7, 1935, p. 52 (Pak Jong, Hin Lap, and Lat Bua Kao, Khorat [= Nakhon Ratchasima] province).

Diagnosis: Grayish above; light brown, black-edged band beginning on snout, passes through eye, and from eye around occiput where it becomes much widened; band bordered anteriorly with cream. Body with three W-shaped or butterfly-shaped marks separated by gray bands each with numerous black flecks; tail banded. Six preanal pores in broadly angular series; 40 scalerows between ventrolateral folds; two pairs of chinshields; no median preanal groove; a few widened subcaudal scales may be present.

Description of species (from No. 33377, Pasadet, Sara Buri, province): Rostral about twice as wide as high, subrectangular, standing nearly erect, bordering first labial, nostril, supranasals, and internasal; suture enters from above and extends down distance of about one-half millimeter where it bifurcates, the branches continuing four millimeters farther; nostril surrounded by supranasal, rostral, first supralabial, and two postnasals, the lower continuous with valvelike flap inside nostril; depressed area behind nostril; depression on



FIG. 4.—*Cyrtodactylus angularis* M. Smith. Left figure No. 33377, Pasadet, Sara Buri; actual length, 174.5 mm. Right figure No. 33376, 2 kilometers east of Muk Lek Road Camp, Nakhon Ratchasima province, Thailand. Actual length, 178 mm.

interorbital region continuous with one on frontal area; about 33 scales in row across snout just behind level of second supralabials; about 47 scales across snout between seventh labials; scales on snout mostly flat, pavementlike, those in front of inner edge of eyelid somewhat conical; scales on frontal and interorbital areas growing smaller posteriorly; granules on occiput small, only one fourth to one fifth size of lateral scales on snout, and intermixed with enlarged, usually conical, tubercles; about 56 granules between edges of eyelids across middle of interorbital region; supralabials, 15-14, diminishing in size posteriorly, and followed to mouth-angle by nine scales, not differentiated; infralabials, 10-11, followed by a few undifferentiated scales; labial border of mental little smaller than rostral border; mental subtriangular, followed by median pair of chinshields in contact for at least half their length, nearly twice as long as wide; second pair of chinshields separated by first pair, their length little more than half of first pair; third pair indicated by small scale on one side only; one or two rows of slightly enlarged sublabials; about 87 granular scales in row between first chinshields and line across front of shoulders; scales very small on chin and throat, larger, imbricating on breast; about 103 scales from level of shoulders to vent, variable in size, mostly cycloid, imbricating; an angular series of enlarged scales in preanal region, three on each side bearing preanal pores; this series continuous with a series of twelve enlarged femoral scales without pores; behind preanal porescales four enlarged rows of scales followed by nine rows of small scales reducing in size posteriorly; slight ventrolateral fold on which there is a broken series of enlarged conical tubercles; approximately 48 ventral scalerows between folds, median ones somewhat cycloid, imbricate, outer series much smaller and granular.

About 35 tail segments, basal 15 with about eight transverse rows of small flat tubercles above and on sides, with last two or three interrupted by much enlarged series of six conical or trihedral tubercles; towards posterior part of tail these tubercles reduce from six to four and then to two. Terminal segments without enlarged scales; segments can be discerned with difficulty; median subcaudals enlarged, usually two paired scales and large single scale below each segment; occasionally enlarged scale split longitudinally; postanal openings distinct, large; postanal region strongly swollen in male with three lateral tubercles on each side.

Distal part of digits narrowed, forming crook near middle of digit; fourth finger and toe with six flat scales on basal part, and

12-13 scales on distal part of digit; no webbing present; when leg is adpressed toes reach axilla. Arms and legs with numerous distinct tubercles.

Color in life: Above, head gray-brown with several small darker-edged spots; body gray becoming whitish on latter half of tail. A brown irregular dark-edged stripe from nostril through eye, passes around occiput much widened dorsally, bordered by a light-edged stripe around occiput; three large paired spots or double blotches somewhat W-shaped or butterfly-shaped on back; twelve or thirteen dark bands on tail growing darker posteriorly; bands on body and tail separated by broader gray bands, more or less flecked with dark brown or black, each with a dark-edged ocellus on each side; lip cream with brown spots; chin and venter cream; light bands in subcaudal region flecked with brown or black; dark bands completely encircling tail.

Table of measurements of *Cyrtodactylus angularis*

NUMBER	33376 ♀	33378 ♀	33377 ♂
Snout to vent.....	82.5	92	80
Tail.....	92	regen.	95.2
Total length.....	174.5	.....	175.2
Snout to arm insertion.....	32	36	32.2
Axilla to groin.....	36.5	44	37
Length of head.....	24	25.5	23.5
Width of head.....	18	20	17.6
Arm.....	31.2	32	32
Leg.....	39	41	38
Pores.....	3-3	3-3	3-3
Ventral scalerows between fold.....	45	42	40

Variation: The females have small femoral pores or at least pits or scars on the scales. No. 33376 has all except three of the enlarged subcaudal scales divided; the basal segments have only two series of paired scales usually the anterior pair smallest; more posteriorly there may be two pairs of much smaller scales and one pair of larger scales. This specimen also came from Pasadet.

No. 33378 was taken about two kilometers east of Muak Lek Road Camp (on Friendship Highway) in Nakhon Ratchasima province near its boundary with Sara Buri. All three specimens came from under limestone rocks.

The largest specimen has two large eggs in the body. The regenerated tail of this specimen is about 40 mm. long but is black, the

scales not in rows, lacking tubercles. The gray dorsal bands are darker and the lateral spots are not or scarcely ocellate. The dark flecks on the gray bands usually have linear arrangements.

Besides these specimens Malcolm Smith had three specimens in his type series, one each from Lat Bua Kao, Pak Jong, and Hin Lap, Nakhon Ratchasima province, Thailand.

Distribution: The species is known from only the provinces of Sara Buri and Nakhon Ratchasima.

Cyrtodactylus quadrivirgatus Taylor

FIG. 5

Cyrtodactylus quadrivirgatus Taylor, Univ. Kansas, Sci. Bull., vol. 43, 1962, pp. 210-212, fig. 1 (type-locality Khao Chong, Forest Experiment Station, Trang province, Thailand).

Diagnosis: Small scales under tail, lacking a median series of enlarged plates; four preanal pores in males; in females four very small pores or four scales with deep depressions; no continuous black band extending from eye to eye across occiput; four dark lines from head to tail separated by lighter lines, or the two median dark stripes broken, forming united spots on dorsum. Tail with transverse black bands separated by lighter bands.

Description of type: A rather small species; rostral not twice as wide as high, its upper edge with a V-shaped notch cutting scale half in two, the area of notch being filled with three internasal scales; rostral bordered by these three scales, first supralabial and nostril; nostril bordered by rostral, first labial, a large and a small supranasal, and three small postnasals; 56 scales across snout between fifth supralabials; about 64 small granular scales between median edges of eyelids; eye diameter less than snout length; ten smooth supralabials, posterior ones small, followed by eight or ten small granular scales reaching back to angle of mouth; ten infra-labials, last three small, followed by seven very small scales to mouth-angle; mental triangular with a labial border equal to that of rostral; a pair of chinshields separated for more than half their length by mental; second pair of chinshields separated by five scales, scarcely differentiated; ear diagonally elongate, tympanum deeply sunk; a slight depression on occiput more or less connected with a depression on snout.

Scales on occipital region very small with a few scattered rounded tubercles; dorsum with somewhat larger granular scales intermixed with minute scales and with large conical or pyramidal tubercles



FIG. 5.—*Cyrtodactylus quadrivirgatus* Taylor. Type. Khao Chong Forest Experiment Station, Trang province, Thailand; actual length, 144 mm.

forming about 24 irregular rows; a bare trace of a ventrolateral fold, separated from its fellow by about 40 scalerows, the outer rows small, median ones considerably larger; group of four preanal pores continuous with a series of 17 enlarged femoral scales. Tail above dimly segmented; dorsal scales smaller than ventral ones; no median widened series of scales on undersurface of tail but there may be four or five series subequal in size, a little larger than dorsal caudal scales; no caudal tubercles; tail slender, tapering to a fine point. Legs reach to elbow of adpressed arm; toes subequal, six or seven lamellae under basal part of fourth toe; all digits clawed.

Color in life: Above gray on body; head uniform blackish on top; a distinct black band begins behind eye extending back on sides of body to base of tail, bordered above by a wide gray stripe and below by a narrow one; two other lines begin behind eye and run back to form an angular union on nape; they then separate and continue to tail, where they are rejoined; median gray line interrupted in two places by connecting lines between the two median dark stripes; a very indistinct darker line low on sides; chin and venter uniformly whitish with a peppering of black. Tail banded with black and gray, the basal gray bands including some black; underside of tail blackish with white flecks; gray bands surrounding tail only on distal part; some indistinct lighter flecks on labials; arms and legs with spots or bands of black above, whitish below.

Measurements in mm. (of type and No. 388, a paratype): Snout to vent, 67, 39; tail, length, 77, 22 (broken); snout to arm, 32, 16; axilla to groin, 34, 19; width of head, 13, 8; length of head, 18, 13; arm, 21, 13; leg, 26, 17.

Remarks: The color pattern of the young male topotypic paratype is quite similar to the type. There is, however, some indication of lighter and darker areas on the head. The distal part of the tail has been lost. In the Malayan specimens the two median stripes are broken sometimes forming a series of spots.

The relationship of this species may be with *Cyrtodactylus oldhami*, however, the absence of the enlarged transverse subcaudal series of scales, and the absence of the curving band about occiput from eye to eye suggests a different relationship. *Oldhami* may lack pores. Absence of femoral pores would seem to preclude close relationship with *marmoratus*.

The type specimens were found at an elevation of about 400 meters on Khao Chong, under a decaying log. A specimen of *Cnemaspis siamensis* was taken in the immediate vicinity.

Cyrtodactylus oldhami (Theobald)

FIG. 6

Gymnodactylus oldhami Theobald, Descriptive catalogue of the reptiles of British India, 1876, p. 81 (type-locality unknown; originally said to be South Canara,* India); Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 38; Fauna of British India including Ceylon and Burma, 1890, p. 67; Annandale, Journ. Asiat. Soc. Bengal (N. S.) vol. 1, 1905, p. 83; Rec. Ind. Mus., vol. 9, 1913, p. 320, pl. 17, fig. 2. "The type is a male and one scale of this series (the enlarged scales in the preanal region) bears a distinct pore. In the other males there are 4 preanal pores arranged in two pairs." Mintao, Tavoy district, Tenasserim; Tavoy); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 150 (Maprit and Klong Bang Lai, 60 km. N. Isthmus of Kra); Journ. Nat. Hist. Soc. Siam, vol. 2, June, 1916, p. 51 "Patiyu, Peninsular Siam"; Fauna British India, including Ceylon and Burma; Reptilia and Amphibia; vol. 2, Sauria, Feb. 7, 1935, p. 50, pl. 1, fig. C. "Patiyu district, and Nakon Sritamarat Mts."

Diagnosis: Snout as long as distance between eye and ear-opening; diameter of ear-opening about one half of diameter of orbit. About thirty rows of trihedral tubercles on back and sides; 34-38 ventral scales between lateral folds; paired series of large tubercles on tail; a median subcaudal scale series, transversely widened except at base. Male with 1-4 (total) preanal pores; no femoral pores in enlarged series of femoral scales; no pubic groove; top of head uniform brown; body with elongated or rounded spots arranged in four longitudinal lines. Snout to vent 65 mm.

Description of species from EHT.-HMS., M. 246 (M. Smith 4300): Rostral large, wider (4 mm.) than high (2 mm.) with a median groove from its upper edge halfway to mouth; small supranasal separated from its fellow by two small scales; nostril surrounded by rostral, supranasal, first labial and one other small scale (the upper part of the labial scale excludes several small scales from bordering nostril); twelve supralabials followed by ten or eleven small scales to mouth-angle; 46-50 small scales across eyelids and interorbital region (at middle of eyelid); about 47 scales across snout between fifth supralabials; occipital scales minute, with scattered tubercles; orbit shorter than snout; mental with labial border equal to that of rostral; one pair of enlarged chinshields, forming a mutual suture for half their length, touching infralabials; ten or eleven infralabials; two or three larger scales border labials behind chinshields; auricular opening moderate. A shallow frontal concavity. Digits of hands and feet slender, clawed; distal portion of digit forming an angle with proximal joint; fingers with two or three widened platelike lamellae with an enlarged subarticular plate fol-

* Boulenger (1885) states South Canara. Annandale, *loc. cit.* states that there is no real evidence that the lizard occurs in South India. Malcolm Smith (1935) states that the type-locality is unknown.

lowing these distally; this in turn followed first by two or three divided lamellae and then by several single imbricating scales; fourth toe with six basal lamellae and the enlarged subarticular plate; claws between two plates.

Dorsal scales small, juxtaposed; tubercles intermixed with larger



FIG. 6.—*Cyrtodactylus oldhamii* (Theobald).
Figure of type, from Annandale, Rec., Ind.
Mus., vol. 9, 1913, pl. 17, fig. 2.

rounded, keeled or subtrihedral or pyramidal tubercles forming about twenty irregular rows on dorsum and sides; ventral scales, larger, cycloid imbricating on venter; on neck and chin, scales granular, subequal, juxtaposed; in preanal region a Δ -shaped series of preanal scales much larger than other ventral scales, some of which have pits; this series of scales is continuous with a femoral series of enlarged unperforated scales that extend to end of femur; this series followed behind by two other series of enlarged scales without pits. (Males with one to four preanal pores, rarely absent altogether.) Scales on legs with smaller and larger granules intermixed, and with tubercular scales on underside of forearm and tibia, the scales larger, cycloid, imbricating. Tail segments not clearly indicated except basally where three or four segments have a whorls of four or six enlarged keeled tubercles, the other scalerows consisting of small imbricate scales. There is a subcaudal series of enlarged transverse scales (occasionally divided) continuing to regenerated part of tail. They begin a short distance behind the vent (making approximately a total of 94 in specimens with a complete tail).

Color: Above gray-brown, top of head nearly uniform brown; a dark band curves from eye to eye behind occiput, bordered in front and behind by a cream-line; dorsum brown with a series of four longitudinal lines of small cream or whitish dots. Tail dark brown with dorsal cream-bars often passing under tail, many of the dorsal and especially lateral tubercles with bright cream-yellow tips; dirty whitish below.

Measurements in mm.: (EHT-HMS Nos. M. 246, and M. 247) Snout to vent, 68, 63; tail, 69 (regen.), 70 (tip regenerated): width of head, 13, 13; length of head, 21.5, 20; arm, 22, 20; leg, 32, 30.

Variation: The second specimen, No. M. 247, has two oviductal eggs.

Males may have a series of four preanal pores or they may be reduced to one. The female specimens show small pits in the scales. Trace of a small ventrolateral fold can be seen in the described specimen but not in the gravid female. There are about thirty-three scales between ventrolateral folds.

Distribution: The species has been taken in the provinces of Chumphon and Nakhon Si Thammarat, the specimens here listed being from the first province. These bear M. Smith's tags, nos. 4300 and 4299, respectively. They are from about 60 miles north of the Isthmus of Kra.

Remarks: Malcolm Smith reported three specimens from Maprit, a station on the Southern Railway, 15 km. inland from and due west of Patiyu; and from Klong Bang Lai, a camp on a stream of the same name 12 kilometers northwest of Maprit in the district of Patiyu-(Chumphon). The only male, a half grown one, has no preanal (or femoral) pores. "One scale bears a slight impression but is not perforated." He reports that the variation in pores is from 0-4.

Cyrtodactylus peguensis (Boulenger)

Gymnodactylus peguensis Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 314, pl. 7, fig. 2 (type-locality, Palon, Pegu); Laidlaw, Proc. Zool. Soc. London, 1901, p. 304; Boulenger, A vertebrate fauna of the Malay Peninsula . . . 1912, p. 36 ("Patelung and Legeh"); Annandale, Rec. Ind. Mus., vol. 7, 1912, p. 91; *ibid.*, 1913, p. 323; M. Smith, Journ. Nat. Hist Soc. Siam, vol. 2, 1916, p. 150 ("Khao Wang Hip, Nakhon Sritamarat," "80 mm. snout to vent"); Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 50-51; Proc. Zool. Soc. London, 1921, p. 427, text fig. 1a.

This species whose type-locality is Palon, Pegu District, Burma, is known from very few specimens. Annandale first reported its presence in Thailand in 1912 at Patthalung; later Malcolm Smith obtained specimens from the area about Nakhon Si Thammarat from the province of the same name. He also described a large form, 80 mm. snout to vent from the Langbian Plateau in southern Annam in 1917 which he named *peguensis irregularis*, while specimens from southern Thailand were referred to the typical *P. peguensis*. Specimens of a *Cyrtodactylus* from Central Thailand were named *peguensis angularis*. In his later work (Smith 1935), *irregularis* and *angularis* were both correctly recognized as distinct species.

Two specimens taken at Khao Chong, Forest Station, in the mountains of Trang province differ from the typical forms from Pegu some 800 miles northward. The difference is largely in the detail of the dorsal markings and the relationship of the labial to nostril and the larger ventral scales resulting in fewer ventral rows. It is not recognized as being subspecifically distinct. Numerous specimens were taken at Na Bon, Nakhon Si Thammarat.

The description of *peguensis* given by Boulenger (1912) and quoted by Annandale (1913) is taken from the type-description and not from a Malay specimen. The specimen figured by Malcolm Smith (P. Z. S. 1921) is most probably from Burma. On page 427 he states of the *forma typica*: "7-8 preanal pores; 9-11 upper and 7-9 lower labials; two series of (6-8) large round spots on the back

or with the spots confluent transversely." It may be that the specimen showing "spots confluent transversely" is the subspecies described herein as *Cyrtodactylus p. zebraicus*.

Cyrtodactylus peguensis peguensis (Boulenger)

FIG. 7

Diagnosis: Head with about 18 spots separated by a reticulum of cream; a sharply defined stripe from behind eye around occiput widening and somewhat angulate on dorsum of neck; seven or eight pairs of dark-brown or black spots, flanked laterally by a series of lateral vertical bars their upper parts brownish black, their sides blackish, their lower parts gradually becoming white and lost on venter; body spots separated by narrow reticulum of cream-white. Arms and legs somewhat barred with light and dark; the nine black rings surrounding tail, separated by white rings about half as wide as black rings, and each bearing a pair of black flecks (often other flecks may be present). No ventrolateral folds; approximately 32 scalerows across venter; seven to nine preanal pores forming a wide angle. Subcaudals (except for basal 15 mm. of tail), enlarged, transverse; the first labial enters nostril.

Description of species (from No. 35749, Khao Chong, Forest Station, Trang): Head moderately flattened, with depressed interorbital area continuous with depressed frontal area; sides of snout somewhat compressed, with slightly depressed area behind nostrils; rostral (3 mm. wide, 1.6 mm. high) bordering nostril, first infralabials, two supranasals and a small internasal; a straight median suture enters from above and extends down on scale a distance equal to half its height; nostril surrounded by rostral, two supranasals (the posterior small), first labial, and postnasal that is fused to valvelike flap within nostril; 30 scales across snout at posterior level of second labials; 41 scales between middle of fifth labials; across head, 46 scales between palpebral scales at middle of eyelids; scales on occiput smaller than elsewhere on head, intermixed with small rounded conical tubercles much smaller than those on dorsum of body; infralabials, 11-11, diminishing in size posteriorly, followed behind to mouth-angle by seven small scales; infralabials, 9-9, followed by five small scales to mouth angle; mental with labial border distinctly less than that of rostral, in contact behind with a pair of chinshields nearly three times as long as wide and in contact for more than half their length; one or two other pairs lateral to first, widely separated; two rows of somewhat enlarged sublabials; about

74 granules in a line on chin and throat between chinshields and a line in front of shoulders, the posterior scales enlarged and cycloid; approximately 72 scales from front of shoulders to vent along median line.

Scales on dorsum of body, small, subequal, intermixed with about 20 irregular rows of large conical or trihedral tubercles; arms lacking distinct tubercles; legs tubercles numerous; two or three large tubercles at side of postanal swelling; postanal pockets distinct; preanal pores in large quadrangular scales forming a broad A-shaped series of seven pores; no femoral pores or enlarged scales contiguous with pore-series; tail segmented, each segment with about seven imbricating rows, last two rows broken, by six (basally), four or two enlarged tubercles; below, on tail, scales of transverse series increase in size; on basal part of tail scales somewhat irregular, but from there on median series transversely widened, two to each segment; about 71 subcaudals, the terminal ones small and but little differentiated; digits short, basal lamellae not much widened, five or six under each digit; distal part of digit somewhat compressed; claws present on all digits, each claw surrounded by two scales; no enlarged scales at heel; ear-opening (1.5 mm.) contained in diameter of orbit (4.4 mm.) about three times.

Color in life: Above head and body with brown or blackish brown spots separated by reticulum of cream; on back seven or eight pairs, these flanked laterally by a series of lateral vertical bars, their upper parts brownish black, their sides blackish, their lower parts gradually becoming white and lost on venter; tail banded in dark brown or black; bands separated by white bands somewhat more than half as wide and bearing black flecks. Chin venter, and under limbs, whitish; venter with peppering of black pigment, visible under a lens.

Measurements in mm. (Nos. 35749, 35748): Snout to vent, 60, 67; tail, 61, 53 (regenerated); total length, 121, 120; snout to arm-insertion, 24, 28; axilla to groin, 28, 31.5; width of head, 12.8, 14; length of head, 19, 21; arm, 22, 25; leg, 27.5, 32.

Remarks: The second specimen, also a male, has a regenerated tail that is entirely gray-black with numerous darker flecks above and below. My specimens were captured from masses of plants at the base of forest trees near a stream, late in the afternoon. The specimens were exposed by tearing apart masses of plants and trash.

Distribution: Known in Thailand from Trang and Nakhon Si Thammarat provinces.

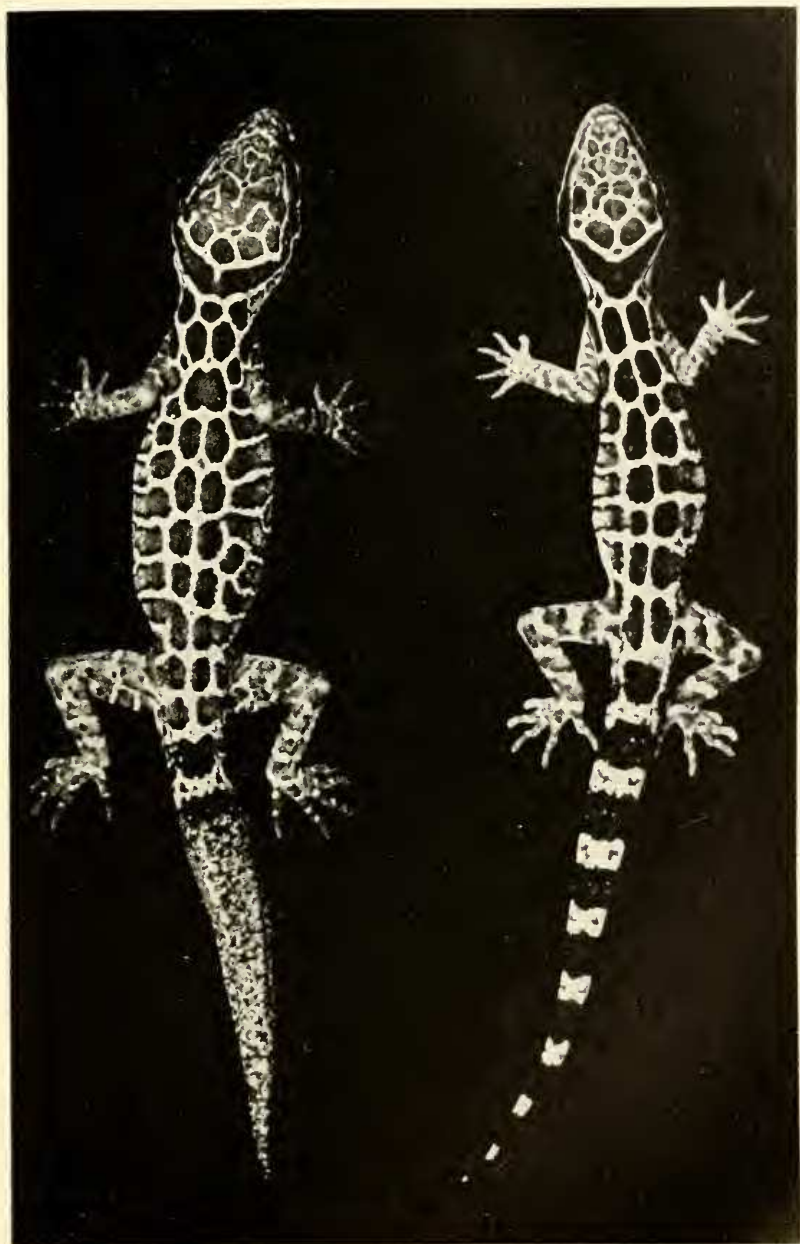


FIG. 7.—*Cyrtodactylus peguensis peguensis* (Boulenger). Left figure, No. 35748 Khao Chong, Trang province. Actual total length, 120 mm. Right figure, No. 35749 ♂, same locality, length, 121 mm.

Cyrtodactylus peguensis zebraicus Taylor

FIG. 8

Cyrtodactylus peguensis zebraicus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 213-215, fig. 2 (type-locality, Tonka Harbour Tin Dredging Co., Ronpibon, Nakhon Si Thammarat, Thailand).

Diagnosis: Head somewhat depressed, spotted above; brown bar behind eye more or less confluent with angular band bordering occiput behind; body with pair of spots on neck and eight transverse stripes wider than gray interspaces; certain of these may be discontinuous, while last, between legs, broken mesially; eight femoral pores; no ventrolateral fold.

Description of type: Head moderately depressed; length of snout a little longer (1.1 mm.) than distance between orbit and ear-opening; strongly depressed area on frontal region extending back between orbits; snout rather compressed with slight depression in front of nostril; rostral about twice as wide as high, bordering nostril, first labial, pair of supranasals, and two small internasals; nostril surrounded by first labial, rostral, two supranasals one large and one small; postnasal seemingly fused to flap within nostril.

There are 32 scales across snout between posterior ends of 2nd supralabials; across snout between anterior part of fifth labials, 49 scales; occipital region with small scales intermixed with rounded, somewhat conical tubercles, much smaller than tubercles on back; supralabials, 11-11, very small posteriorly, followed to angle of mouth by five or six small scales; nine infralabials, followed by four scales to mouth-angle; pair of chinshields, about twice as long as wide forming a common suture for about half their length; mental with labial border distinctly larger than rostral border; second pair of chinshields about half as large as first pair, widely separated by first pair; 77 granules in a row between chinshields and a line drawn from front level of shoulders; from breast to vent, 76 scales; a wide-angled series of eight preanal pores with two angular rows of larger scales between pores and vent; two large lateral postanal tubercles. Tail lost and beginning to regenerate.

Digits short, basal part scarcely widened with two or three flat imbricate scales; distal part somewhat compressed; two scales surround claw; no ventrolateral folds; about 35 scalerows across venter. Scales on sides and dorsum small, equal, interspersed with about twenty rows of enlarged trihedral tubercles. Diameter of ear-opening (1.2 mm. high) four times in diameter of orbit (5 mm.); adpressed leg does not reach axilla.



FIG. 8.—*Cyrtodactylus peguensis zebraicus* Taylor. Type. Ronpibon, Nakhon Si Thammarat, Thailand. Actual length, 58.5 mm.

Color in life: Above blue-white with transverse brown stripes with blackish edges. Head with about twenty dark spots in a blue-white reticulum; venter and chin cream-white with fine powdering of black, visible under a lens. Dark band from eye passes around occiput, angular rather than curving; lips dark spotted; regenerated tail blackish.

Measurements in mm.: Snout to vent, 58.5; snout to arm-insertion, 23; axilla to groin, 26; width of head, 12; head length, 19.4; arm, 22; leg, 28.

Remarks: This specimen was taken from a large rotting stump in the forest at Tonka Harbour Tin Mine, Rongpibon, Nakhon Si Thammarat. Its relationship is certainly with *Cyrtodactylus peguensis*, but whether a species or subspecies there may be question.

Cyrtodactylus intermedius M. Smith

FIGS. 9, 9a

Gymnodactylus intermedius M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1917, pp. 221-222 (type-locality, Khao Sehab (Mt.) near Chanthaburi, Chanthaburi province, southeastern Thailand); Fauna of British India, including Ceylon and Burma: Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 44-45, plate 1, fig. F, (Kamchay mountains, Cambodia, Koh Chang Id. Gulf of Siam); Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1081-1082 (? Phatthalung, Thailand).

Diagnosis: Male with eight to ten preanal pores in a wide-angled series; a group of enlarged preanal scales and a series of from six to ten enlarged femoral scales; ventrolateral folds distinct, separated by from 40 to 50 scalerows on venter; ear-opening less than half diameter of eyes; subcaudal plates transversely widened; a cream-edged, dark-brown band from eye around occiput; four bands cross body; tail banded in dark and light; resembling *C. pulchellus* but lacking longitudinal median preanal groove.

Description of species (from No. 35440, topotype): Rostral not twice as wide as high, upper part bending backward with a median entrant suture from above, forming anterior border of nostril, touching first labials and three median scales, two supranasals and an internasal; first supralabial, two postnasals, supranasal and rostral complete border of nostril; three somewhat enlarged scales bordering supranasal behind; two median scales behind small median internasal; depressed areas behind nostrils; forehead somewhat concave; about 27 scales across snout between posterior level of second supralabials; approximately 49 scales across snout between seventh labials; approximately 51 granules between palpebral borders of



FIG. 9.—*Cyrtodactylus intermedius* (M. Smith). No. 35440 Khao Sebab, Chanthaburi Thailand. Actual snout-vent length, 61 mm.; total length, 93 mm.

eyelids at middle; scales on snout three or more times larger than scales on occiput or interorbital area; granules on back small with about 17-18 irregular rows of enlarged conical or trihedral tubercles; granules above eye unequal in size; ear-opening small, its diameter (1.5 mm.) about one third of the diameter of eye (4.5 mm.); eye to ear-opening (5.5 mm.) less than snout length (7 mm.); supralabials, 11-11, followed by nine small, scarcely differentiated scales; infralabials, 11-11, followed by ten or eleven small scales to mouth-angle;

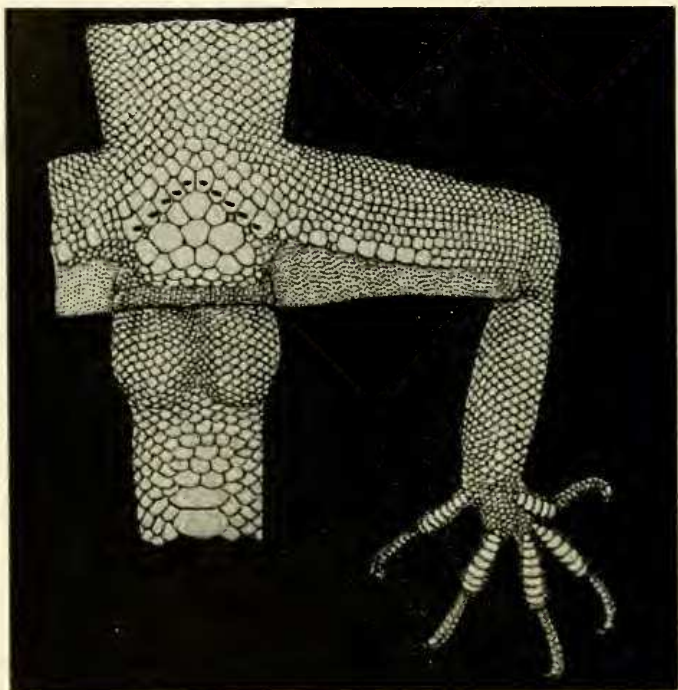


FIG. 9a.—*Cyrtodactylus intermedius* (M. Smith). From M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 3, 1917, pl. —, fig. 2.

mental subtriangular with a labial border equal to or slightly greater than rostral border on mouth; median pair of chinshields twice as long as wide, in contact for less than half their length; second chinshields separated, about half length of the median pair; third pair of scales less than half size of second pair; approximately 100 scales in a row from chinshields to level of shoulders; about 95 scales from front of shoulders to vent at median ventral line; about 45 scalerows between two well-defined ventrolateral folds; no pre-anal pores in female but a series of ten enlarged pore-scales in

preanal area, followed by two or three rows of equally large scales; a row of seven or eight larger femoral scales (males with six to ten preanal pores forming a wide angle).

Dorsal surface of body with fine granular scales mixed with about 16 rows of enlarged rounded conical or trihedral scales; tubercles noticeably developed on dorsal part of legs, smaller and inconspicuous on arms; seven or eight lamellae on basal part of longest finger, about ten under longest toe; beyond lamellae the toe bends upward then forward making a distinct crook; underside of base of tail with about 21 small scales; remainder with transversely enlarged scales two to each segment; above, on each segment nine smaller transverse scalerows and a row of four enlarged tubercles placed near posterior part of segment, sometimes two smaller ones preceding these.

Color in life: Above light brown, nearly uniform with a series of four dark-brown bands, bordered or dotted on edges with cream, crossing dorsum and reaching lateral fold; one cream-edged band beginning behind eye runs back and around occiput; venter yellowish cream with a fine powdering of dark pigment, more intense under tail; tail banded in dark brown and tan near base more distally dark bands become black, tan bars become almost white; arms gray-brown, nearly unicolor; legs with numerous cream-colored tubercles. Top of head nearly uniform brown.

Measurements in mm.: Snout to vent, 61; tail (broken), 32; head-width, 12; head-length, 20; snout to arm-insertion, 24; axilla to groin, 29; arm, 23; leg, 31.5.

Remarks: There is considerable superficial resemblance between this species and *Cyrtodactylus pulchellus*. The completely different arrangement of the scales on the femoral and preanal regions together with certain other difference in the relative size and proportions of scales amply distinguish these forms.

The species has been taken in southeastern Thailand, Khao Sebah (mt.) near Chanthaburi, Chanthaburi province, and on the (island) Koh Chang in the Gulf of Siam. Malcolm Smith also reports the species in the Kamchay Mountains in Cambodia.

My specimen was taken at an elevation of about 500 meters on Khao Sebah from under bark of a rotting stump. Only the single specimen was seen.

It seems well to question the locality data (Phatthalung) on a specimen in the Boonsong collection reported by Taylor and Elbel (1958). Certain original tags had disintegrated and others had replaced them.

Genus CNEMASPIS Strauch

Goniodactylus (non Kuhl, 1826) Gray, Zoological Miscellany, 1842, p. 58 (type-species, *boiei*).

Cnemaspis Strauch, Mem. Acad. St. Petersburg, vol. 35, 1887, p. 41 (type of genus *Cnemaspis boulengeri*).

Paragonatodes Noble, Amer. Mus. Nov., no. 4, 1921, p. 14 (type of genus, *Gonatodes dickersoni*).

Diagnosis: Digits slender, clawed, not dilated (in Thai species); two distal phalanges compressed, forming an angle with the basal portion of the digit, the lower surface of which has a row of plates; body more or less depressed, granular, or tubercles mixed with granules. Tail more or less cylindrical; pupil round; "eyelid" distinct all around the eye; preanal or femoral pores, or both may be present. Four species of the genus are known to occur in Thailand. They may be distinguished by the following key:

KEY TO THAI SPECIES OF CNEMASPIS

1. Femoral and preanal pores present. Diminutive species with preanal pores widely separated from the femoral pores; some small spine-like scales scattered on flanks *mysoriensis* 2
 Femoral pores absent; preanal pores normally present
2. Base of the raised portion of the digits without one or two thickened plates, these being replaced by small irregular scales. Tail with small keeled scales below; snout with distinct canthal ridges; five transverse yellow bands on body, and the two anterior bright; no large tubercles on tail *affinis*
 Base of raised portion of digits with one or two thickened plates; canthal ridges indistinct or absent; tail with whorls of large tubercles 3
3. Subcaudal area with a somewhat enlarged median series of pointed scales; 2 to 8 pores in preanal region (sometimes abnormally absent); two median rows of tubercles not forming straight lines, *siamensis*
 Subcaudal area smooth with a median series of somewhat rounded scales (not pointed), three to each segment, the third of each group largest; the two median rows of enlarged dorsal tubercles form straight lines; 3-4 minute preanal pores separated mesially by two scales *kumpoli*

Cnemaspis mysoriensis (Jerdon)

Gymnodactylus mysoriensis Jerdon, Jour. Asiat. Soc. Bengal, vol. 22, 1853, p. 469 (type-locality, Bangalore, India).

Gonatodes mysoriensis: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 68; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 77.

Cnemaspis mysoriensis: M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 72.

Diagnosis: Small species with from two to three preanal pores, and three to five femoral pores; preanal pores separated from vent by about ten rows of scales; some enlarged scattered scales on dorsum and fine scattered conical tubercles along the flanks; mental large; ear-opening small; diameter of orbit distinctly less than length of snout.

Description of species (from EHT-HMS M 257 (M.S. 4307) from Tasan, Prachuap Khiri Khan): Snout broadly flattened; rostral very broadly visible from above, followed behind by two supralabials and a pair of supranasals; latter separated by a scale nearly as large, which is wedged into notch in rostral and preceded by a short groove; nostril surrounded by rostral, labial, supranasal, and one (possibly two) postnasals; 10 or 11 scales between sutures of first and second labials across snout; while between the fifth labials, 26 to 28 scales; diameter of orbit (2.7 mm.) shorter than snout (3.2 mm.); auricular opening small, diagonal, its distance from orbit, two millimeters; seven supralabials; infralabials 7-7; mental with a larger labial border than rostral, followed by a pair of chinshields, separated by a single scale; a second smaller chinshield also in contact with infralabials, separated from its fellow by three small scales; scales of chin juxtaposed, larger than those of throat; scales on neck, breast, and venter cycloid, strongly imbricating; scales on dorsum and sides larger than occipital scales which are in turn a little smaller than those on snout. A few small tubercles, usually flat, indistinct, with none or but very indistinct keels; a few scattered conical or flattened spiny scales low on sides and in groin area; a pair of preanal pores widely separated by 10-12 scales from a series of 4-3 femoral pores.

Tail with whorls of tubercular spines, six to each basal segment, those low on sides sharpest more nearly erect; subcaudal scales keeled, median series enlarged, but not transversely widened; a large spine at base of tail on each side (small in female); (distal part of tail missing).

Four outer fingers with their basal portions covered with four enlarged flat lamellae, the fourth largest; distal portion of digits compressed, with small scales beneath; toes with large undivided scales under basal part, or with one or two proximal scales divided.

Color: Specimens brownish with numerous small lighter tan spots, especially evident on sides of neck and on digits; tubercles on back light as are the fine spines along sides and in groin; ventral

surfaces much lighter, the throat, breast, underside of limbs, and tail with fine brown pigment; middle of venter without pigment.

Measurements in mm.: Snout to vent, 30; tail missing; width of head, 5.3; length of head, 9.2; snout to arm, 13; axilla to groin, 13.3; arm, 11 \pm ; leg, 14.5 \pm .

Variation: The four specimens all from the same series are dried somewhat and the tails are missing. The measurements are somewhat inaccurate because of drying.

The preanal pores are two in the three males (in one case they are separated mesially by a single scale). The femoral pores are 4-3, 5-5, 5-5.

There may be a broad median yellowish stripe, broken occasionally into spots.

Remarks: It may seem somewhat surprising to find a southern Indian species represented in Thailand. The basis of this record is a series of specimens collected by Dr. Malcolm Smith at Tasan, Prachuap Khiri Khan; Koh Yan Yan, and Koh Lang, islands in the Gulf near the Isthmus of Kra. These specimens were made available to me by Mr. Boo-liat of Kuala Lumpur. The specimens bear Dr. Smith's numbers, within the series 4301-4308, engraved on the characteristic tin tags. I cannot find that he ever reported on these specimens.

The small size of the species; the two or three preanal pores widely separated from the three to five femoral pores; the very large mental as well as numerous other characters make this identification certain.

The specimens have been dried somewhat at some time and are brittle so that accurate measurements of the limbs could not be made.

It is true that there is considerable similarity between *mysoriensis* and *kandianus* and their relationship may be subspecific.

Cnemaspis siamensis (M. Smith)

FIG. 10

Gonatodes siamensis M. Smith, Journ. Sarawak Mus., vol. 3, 1925, p. 21 (type-locality "Maprit, Patiyu", 60 km. N. of the Isthmus of Kra, Thailand); Bull. Raffles Mus. no. 30, Apr. 1930, p. 16; ("Nakon Si Thammarat mountains, Phuket, Krabi, and Tasan in the northern part of the Malay Peninsula. Also in south Tenasserim, Burma and in the mountains near Chantaburi").

Gonatodes kendalli: (*non* Boulenger) M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 151.

Cnemaspis siamensis: Smith, The Fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 71-72.

Diagnosis: Small ground- or rock-dwelling gecko, with numerous rows of enlarged conical, trihedral, or tricarinate scales; ventral scales, cycloid, imbricating, usually tricarinate; mental large, its labial border a third longer than that of rostral; tail slender, somewhat compressed laterally, subcaudal scales enlarged but not trans-

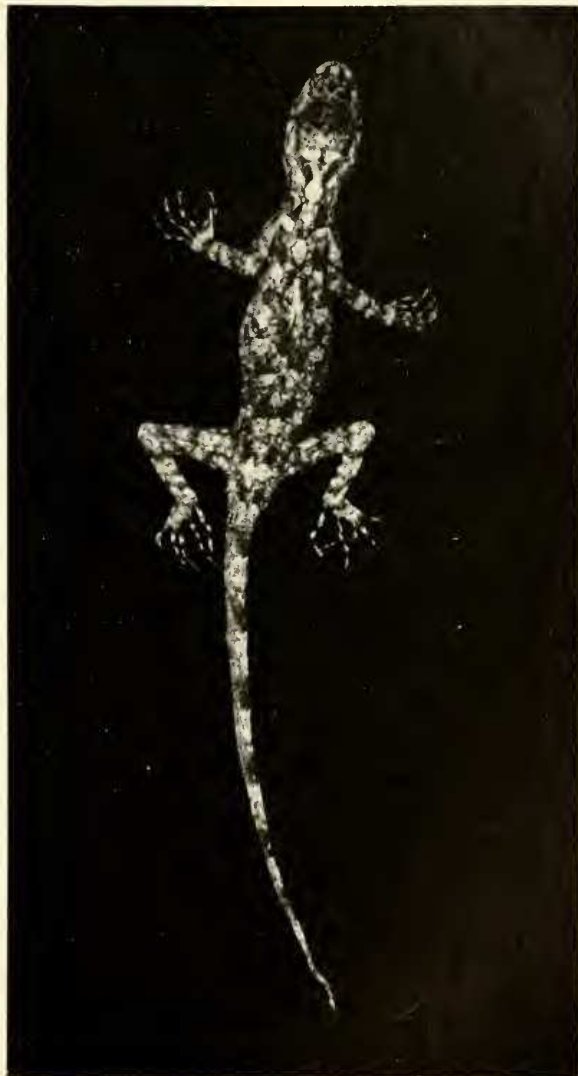


FIG. 10.—*Cnemaspis siamensis* (M. Smith). No. 35696, Khao Chong Forest Experiment Station, Trang province, Thailand. Actual length, 86.2 mm.

versely widened. Most caudal scales, except two or three unicarinate rows, tricarinate (or with two grooves), each segment with 8-10 transverse scalerows, and a row of much enlarged tricarinate tubercles. Preanal pores in male; digits without webs, very slender, all with claws.

Description of species: (from No. 35696, Khao Chong Forest Station, Trang province, Thailand). Snout rather broad, rounded at tip, longer than distance between eye and ear-opening. Rostral large, not twice as wide as high; a large groove or suture enters upper edge and continues down for about four fifths of its height, almost dividing scale; laterally rostral touches first supralabial, posteriorly two supranasals and an internasal; nostril surrounded by rostral, supranasal, and three small postnasals; about 24 scales across snout between mutual sutures of first and second labials; 44 across snout between fifth labials; eight supralabials, anterior ones rather narrow, elongated, and these followed to mouth angle by a row of five or six small undifferentiated scales; ten infra-labials, anterior ones wider than long, posterior ones narrow, elongate; mental proportionally very large, its labial border at least a third greater than that of rostral, separating first pair of chinshields, which are a half longer than wide, separated posteriorly by a single scale; two other small scales in contact with labials may represent second and third pairs of chinshields; about 37 scales in a line across interorbital region between middle palpebral scales; a distinct depression behind nostrils; only a slight depression in inter-orbital and frontal regions, scarcely discernible; scales on occiput smaller than scales on snout, intermixed with somewhat larger tubercles but these much smaller than the 18 or 20 irregular rows of tri-keeled, rounded, conical or trihedral tubercles intermixed with small juxtaposed granular scales on dorsum; no tubercles on limbs, but scales, especially on front side of limbs, strongly keeled, bearing two to four keels; venter covered by about thirty rows of rounded, imbricate, tricarinate scales; female without pores (male with two to eight preanal pores which may sometimes be absent altogether (*vide* M. Smith)); limbs elongate, slender, unwebbed; digits narrow, elongated, and distally slightly compressed; distal phalanges rising from basal part at an angle; basal part of digit with flat lamella the terminal one of each series being an enlarged plate; basal part of distal phalanges with one or two divided scales or a row of small scales; remainder with large plates, or lamellae, a little smaller than those on basal part of digit, 24 to 25 under longest

finger, 25 under longest toe. Ear-opening small, one millimeter in greatest diameter; diameter of the bony orbit of eye about 4.4 millimeters.

Color in life: Above gray-green with darker brown markings; a pair of lines behind eyes converge to a light spot on nape; this light spot preceded by two lighter spots, separated mesially by a small brown spot; two or three lighter areas on side of neck and shoulders. Entire body more or less mottled in brown and light, the brown tending to form transverse bars on back of body; ten bars on tail which cannot be traced to underside of tail. Venter slightly yellowish-white with a peppering under tail of much darker brownish pigment.

Measurements in mm.: Snout to vent, 36.2; tail, 50; total length, 86.2; snout to arm-insertion, 14.1; axilla to groin, 17.2; width of head, 6.5; length of head, 10.7; arm, 16; leg, 21.

Variation: Two males taken in 1960 at Khao Chong are numbered 444 and 390, respectively. The preanal pores are 3-2, separated by a single scale, and 4-4, again separated by a single scale. There are no femoral pores. The median subcaudal scales have single keels and are larger than the adjoining rows.

The pattern of markings is similar in all three specimens. The two pairs of cream marks in front of the shoulders and above the axillae are well marked.

Distribution: The distribution in Thailand is in the southern peninsular part, 60 km. north of the Isthmus of Kra and south, at least as far as Khao Chong, Trang. It occurs also in southeastern Thailand near Chanthaburi.

Remarks: This diminutive species is primarily a rock-dweller but may be found on the buttresses and trunks of trees in the general vicinity of rocks. Several individuals presumably of this species were seen in inaccessible crevices among boulders. The specimen described was caught on a tree buttress growing alongside several large boulders. It was moving about in the morning, suggesting that they are at least partially diurnal in their habits.

These lizards move over the rocks and tree trunks with considerable speed despite the absence of adhesive lamellae. Formerly they were regarded as congeneric with *Gonatodes*. However, the presence of the postanal sacs and true preanal pores are two easily discernible characters that separate them. The digital characters serve as well. In fact they are members of different families.

Gonatodes with its curious scutecheon scales on the venter is placed in the family Sphaerodactylidae, while *Cnemaspis* is placed in the Family Gekkonidae.

The described specimen, contains two equal-sized ovarian eggs. A spider is the only food in the stomach.

Malcolm Smith states that while two to eight preanal pores, in an angular series, is the normal condition, the pores may be absent altogether in males! The pores are not present in females. Smith states that the dorsal tubercles are in "12 or 14 fairly regular longitudinal rows." In this specimen there are 18 or 20 and these are not in regular rows save that they do form indistinct diagonal transverse rows posteriorly.

Cnemaspis affinis (Stoliczka)

FIG. 11

Cyrtodactylus affinis Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, 1870, p. 167, pl. 10, fig. 1 (type-locality Penang Island, Malaya).

Gymnodactylus affinis: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 42; Flower, Proc. Zool. Soc. London, 1896, p. 862; *ibid.*, 1899, p. 627.

Gonatodes penangensis Flower, Proc. Zool. Soc. London, 1896, p. 863, pl. 44, fig. 1 color, 1a, 1b, 1c, black and white (type-locality, "The Crag" Penang I., elev. 2200 ft., Malaya).

Gonatodes affinis: Flower, Proc. Zool. Soc. London, 1898, p. 455; *ibid.*, 1899, p. 627; Laidlaw, Proc. Zool. Soc. London, 1901, vol. 1, p. 304; Boulenger, Fasciculi Malayenses, Zoology, vol. 1, 1903, p. 149; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, pp. 38-39; M. Smith, Journ. Sarawak Mus., vol. 3, 1925, p. 23; Bull. Raffles Mus., no. 3, 1930, p. 16 (Pattani).

Gonatodes kendalli: (non Boulenger) M. Smith, Journ. Federated Malay States Mus., vol. 10, 1922, p. 268.

Diagnosis: Snout with canthal ridges, elongate, its length nearly twice diameter of orbit. Intermediate phalanx, between basal and terminal, covered below with small scales; five transverse yellow bands, two anterior very bright, posterior somewhat indistinct; tubercles of anterior band a brilliant golden color; underside of head and on throat orange, the sexes alike in color.

Description of species (from type-description of "*penangensis*"): Habit very slender. Head oval; snout broad and rounded, depressed, with canthal ridges developed, longer than distance between eye and ear-opening, nearly twice diameter of orbit. Eye large. Ear-opening vertically oval. Limbs long; digits long and slender, compressed. Character of scales on lower surface of digits of both hands and feet at once separates this species from *G. kendalli*, in which they are entirely covered with small transverse lamellae, while in this species, through the basal and terminal parts

of phalanges have transverse lamellae, intermediate part is covered with small irregular scales; a large oval plate at articulation of basal and proximal phalanges, as in *G. kendalli*; upper surfaces covered with minute granules, intermixed on body with irregularly arranged small tubercles, bearing slight keels. Rostral large, quadrangular,

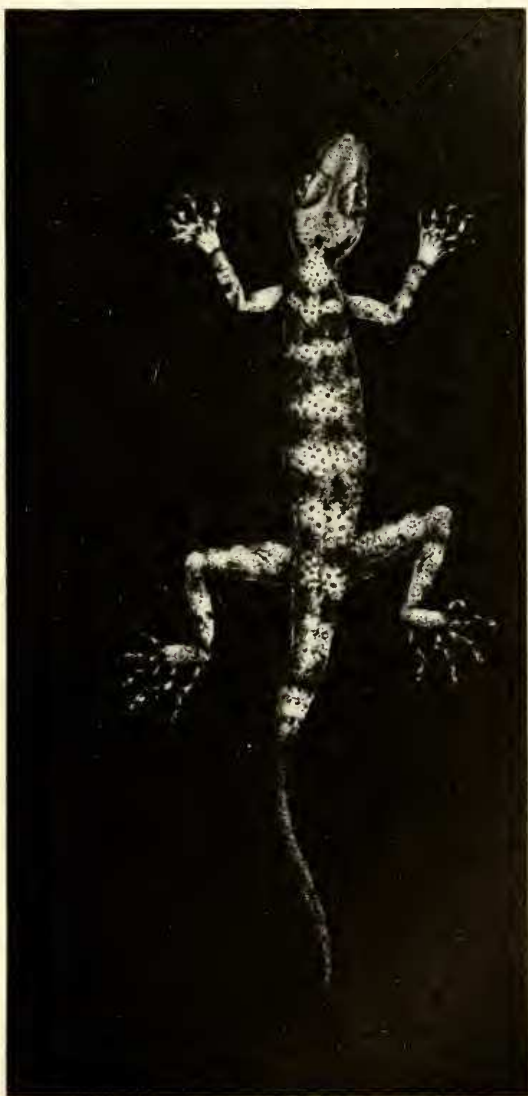


FIG. 11.—*Cnemaspis affinis* (Stoliczka). Figure from Flower, Proc. Zool. Soc. London, 1896, pl. 44, fig. 1 ("*penangensis*").

not twice as broad as high, with a median cleft. Nostril between rostral and several small scales. Nine to thirteen upper, and nine to eleven lower labials. Symphysial [mental] very large, subtriangular. Two large chinshields; two or three scales on chin following mental, slightly enlarged. Abdominal scales very small, juxtaposed, convex, keeled. Male with five to seven preanal pores, arranged in an obtusely angular or crescent-shaped line. Tail cylindrical, slender, with small keeled scales and some pointed tubercles; but in none of the four specimens examined is there the series of large spines which are to be seen in some specimens of *G. kendalli*.

“Colour (from life): Iris orange or yellow. Above yellowish brown mottled with dark brown; deepest (rich red-dark-brown) on shoulders. Five transverse yellow bands, two anterior very bright; three posterior more or less indistinct in some specimens; tubercles on two anterior yellow bands are of a most brilliant yellow colour. Below, head and throat bright orange, remainder purplish-gray, shading to buff on chest and extremities of limbs. Tail with alternate bands of light and dark brown; in one specimen there are sixteen of these bands, and tubercles on lighter bands white. The sexes seem to be coloured alike.”

Measurements in mm.: Total length, 93; snout to vent, 48; tail, 45; head length, 12.5; head width, 7.5; arm, 20; leg, 26.

Distribution: In Thailand the species has been reported from Bukit Besar, Jalor [= Pattani]. It occurs widely in Malaya.

Remarks: Concerning the types Flower states: “I found these Geckos in March 1896, numerous in two small caves in the rocks at the ‘Crag,’ Penang, at an elevation of 2200 ft. in which they were to be found running over the walls both by day and night; at dusk they could also be found on rocks in the open. They are very active.”

Cnemaspis kumpoli sp. nov.

FIG. 12

Type: EHT-HMS No. 3870. Khao Chong, Forestry Experimental Station, Trang province, Thailand. Edward H. Taylor, coll., Sept. 1961.

Diagnosis: First supralabial with anterior portion higher than posterior, the scale excluded from nostril; some posterior supralabials with longitudinal keels; median subcaudal scales smooth, distinctly larger than adjoining rows, only slightly wider than long,

three scales to a tail segment, the third largest of the three; basal tail segments each with a whorl of four large dorsal tubercles, more distally with two or none. Tail and body with transverse bands of blackish gray and light gray; minute preanal pores, 4-3, separated mesially by two scales, separated from vent by six scalerows, and three or four rows of fine granules.

Description of type: Rostral wider than high, depressed somewhat, mesially, with an entrant groove extending more than halfway across scale; a pair of small supranasals, mesially in contact behind rostral; nostril surrounded by rostral, supranasal and three postnasals, the first labial excluded from nostril; a shallow depression behind nostril; snout broad, rather flattened; a broad, very shallow frontal depression; supralabials 11-11, last three small; certain posterior ones with keels; first supralabial higher anteriorly than posteriorly, narrowly excluded from nostril; scales on snout somewhat low, conical or pyramidal, subequal, except for a group of four or five scales a little larger, bordering the supranasals; mental border on mouth a fourth to a third wider than rostral border; the sides of mental notched by first infralabial, truncate behind; a pair of small chinshields touching first infralabials, but separated by a small scale; 10-11 infralabials, first much the largest, diminishing gradually in size, posteriorly, a slight occipital depression; scales in occipital and temporal areas very small, with a few slightly larger scales some distance above ear-opening; scales on dorsum and sides small, subconical, juxtaposed; two mesial rows of tubercles in a continuous line, separated anteriorly by three small granular scalerows, posteriorly, between leg insertions, by about ten rows of granules; on each side of body eight or more irregular rows of tubercles, rather low dorsally, higher and strongly conical, or pyramidal, laterally, practically all showing one or more slight keels; on sides of nuchal region a longitudinal group of large white tubercles; flanks with nearly uniform granules; about 40 rows of small smooth cycloid scales on venter, smaller on throat, larger under femora; a series of very small preanal pores, separated from vent by seven scalerows and three or four rows of granules; scales on arms and legs sharply conical or pyramidal, usually keeled. Tail segmented, subcircular, without fringe, each basal segment with eight or nine transverse rows of granules and a whorl of four dorsal, semierect tubercles, two present laterally; three specialized tubercles on hemipenial swellings; subcaudal scales distinctly larger than dorsal and lateral caudal scales, median row largest beginning with third segment, about 86 in all; tail terminates in a tiny enlargement.

Limbs long, rather slender; digits slender, their basal portion with a row of flat scales or lamellae, the terminal one, a thickened enlarged plate; from this, the distal angular part of digit arises; this part with a series of lamellae below, usually single, rarely



FIG. 12.—*Cnemaspis kumpoli* sp. nov. EHT-HMS No. 3870, Khao Chong Forestry Experiment Station, Trang province, Thailand. Snout-vent length, 52 mm.; tail-length 68 mm.

divided; all scales and lamellae under fourth toe total 32; adpressed leg reaches to or very near to ear-opening; the arm adpressed reaches to groin; ear-opening nearly vertical, its diameter, approximately 1.1 mm., less than one third of the diameter of orbit.

Color in life: Above generally olive-gray with dark or blackish gray transverse bars on body; a horseshoe-shaped mark from eye to eye extending around occiput bordered by an olive-gray lighter line; two black nuchal marks each bearing a series of enlarged white tubercles; four broad dark bands on body, separated dorsally by bands of gray that narrow much on sides; tail banded in blackish gray and light gray the bands encircling the tail; limbs dimly barred with grayish brown; digits distinctly barred with dark and light gray; chin and venter dirty grayish white each scale with a peppering of darker pigment.

Measurements in mm.: Snout to vent, 52; tail, 68; snout to arm-insertion, 20; axilla to groin, 24.5; width of head, 10; length of head, 13.7; arm, 23; leg, 31.

Distribution: Known only from the type locality.

Remarks: The type was captured at night while collecting with Dr. Robert Elbel, near the forestry shelter house at Khao Chong, Trang province. It was running about on a tree trunk. The key will distinguish it from other Thai species of the genus.

The species is dedicated to Nai Kumpol Isarankura, Curator of Zoological Collections at Chulalongkorn University, Bangkok Thailand, who has been very helpful to me in my study of the Thai faunas.

Genus PHYLLODACTYLUS Gray

Phyllodactylus Gray, *Spicilegia Zoologica*, 1828, p. 3 (type, *Phyllodactylus pulcher*).

Digits clawed, slender, distal phalanges not elevated, with a pair of widened terminal plates separated mesially by a groove into which the claw is retractile; preanal pores absent in Western Hemisphere forms, present or absent in Asiatic, Australian, and African forms. Body covered with small scales, uniform or mixed with conical or trihedral tubercles arranged usually in longitudinal rows; pupil vertical.

Two species of the genus occur in Thailand. They may be differentiated by the following key:

KEY TO SPECIES OF *PHYLLODACTYLUS* IN THAILAND

- Body above with numerous rather large black spots (rarely diffuse); tail banded dark and light; no black stripe from tip of snout through eye to tail; usually six preanal pores; lips strongly barred with cream and black *siamensis*
- Dorsal spots absent or minute if evident, arranged in four longitudinal lines; a black stripe from tip of snout to tail bordered above by a cream-white stripe to shoulder; labials whitish. Nine preanal pores, *melanostictus*

The genus *Phyllodactylus* as now understood, is distributed widely over the earth in Asia, Australia, and Africa and in tropical and subtropical parts of the Western Hemisphere. Four species are known to occur in Asia: two species in Persia and two in south-eastern Asia. There is no evidence to show that the distribution of the genus is continuous in Asia.

There is no certainty that the species occurring in Asia, Africa, and Australia are generically identical with those in America since skeletal and perhaps other significant structures have not been scrutinized. The terminal digital lamellae are similar to those in the Western Hemisphere, but all these, in fact all endemic Western species belonging to the Gekkonidae, lack femoral pores. This latter character is, however, variable in old world *Phyllodactylus*.

The Thai species are completely terrestrial and males have femoral pores. That they are not to be regarded as subspecies is evidenced by the occurrence of both species in Muak Lek, Sara Buri province. Each maintains its own identity, *siamensis* occurring over most of Thailand, while *melanostictus* is known only from the type locality in Central Thailand.

Phyllodactylus siamensis Boulenger

FIG. 13

- Phyllodactylus siamensis* Boulenger, Proc. Zool. Soc. London, 1898, p. 918, pl. 55, figs. 1, 1a (type-locality, Dong Paya Fai Mts., eastern Thailand); Flower, Proc. Zool. Soc. London, 1899, p. 627; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916, p. 52 "Widely distributed; extending into the peninsula as far south as Bangsaphan, Lat. 11° 13'"; Bull. Raffles Mus., no. 3, 1930, p. 20; Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 10; Bourret, Bull. Gen. Publ. Inst. no. 19, 1939(?), p. 51 (South Annam).
- Phyllodactylus pavici* Mocquard, Mission Pavie Indo-China, 1879-95, Lizards, 1904, p. 486, pl. 23, fig. 3 (type-locality Vatana [= Wattena], Thailand).
- ?*Phyllodactylus burmanicus* Annandale, Ann. Mag. Nat. Hist., ser. 7, vol. 15, 1905, p. 28 (type-locality, Tavoy, Burma).

Diagnosis: A small species reaching 52 mm. snout to vent. Terminal part of digits with a pair of widened lamellae; dorsal part of widened area covered with eight or ten scales; a median series of

three or four rows of fine scales on body, flanked on each side by seven or eight rows of keeled trihedral tubercles, the three median dorsal rows separated by at least one row of tiny scales; laterally smaller granules surround keeled scales; lateral scales gradually changing into the somewhat larger cycloid ventral scales, each with a distinct but minute posterior serration; six preanal pores in a curving (or broadly angular) series; scales on tail segments arranged in whorls, usually three transverse rows on each, the posterior row being of large keeled scales; subcaudals widened; young black, with a lateral row of small yellow spots; head, back, and sides with numerous well-defined black spots; lacking a dark stripe from rostral through eye to tail, bordered partly with white.



FIG. 13.—*Phyllodactylus siamensis* Boulenger. From left to right: No. 34267, Bang Saen, Chon Buri; length 94.5 mm.; No. 34269, Bang Saen, Chon Buri, length 95 mm.; No. 35035, mountains east of Udon Thani, Thailand; length, 99.5 mm.

Description of species (from No. 33575, Ang Hin, Chon Buri province): Rostral large, quadrangular, with an entrant suture from above partially dividing scale; a pair of enlarged internasals, each followed by a smaller scale, the pair separated by two granules; nostril surrounded by rostral, two internasals, first labial, and two small postnasals; pupil of eye vertical; "eyelid" visible above eye and palpebral scales on its anterior upper border largest; auricular opening large, its diameter about half of diameter of eye; eight supralabials, sixth below pupil; six infralabials, fifth below eye.

Border of mental on lip larger than that of rostral; mental scale rounding anteriorly, forming a right angle posteriorly; pair of enlarged chinshields touching one labial and forming a median suture at least half as long as the scales; second pair of chinshields smaller, touching first and second infralabials, separated from each other by two small scales; scales on chin granular, gradually increasing in size, becoming as large as ventrals on back part of neck; 23 scales across snout between third supralabials; about 26 granules between median points on palpebral series; a few small tubercular scales intermixed with occipital and temporal granules; rows of trihedral scales begin behind occiput, at first small, growing larger on dorsum; two median series separated on median line by from two to four rows of granules (usually 3), each tubercular scale separated from next in line by small granular scale. Lateral tubercular scales surrounded by small granules, or touching each other at certain points; ventral scales subcycloid, their posterior edges with a fine but distinct serration seen under a lens; dorsal trihedral scales becoming smaller laterally and gradually merging into ventral scales.

Tail cylindrical with rather indistinct segments, each with three transverse series of scales above (posterior series largest) and each with two subcaudals; subcaudals, 58, each with a distinctly serrated edge posteriorly; six rows of scales between first enlarged subcaudals and vent.

Limbs well developed, clawed, pentadactyl, with a pair of widened terminal lamellae, between or just anterior to which claw is partially or completely retracted; five scales on dorsal part of terminal expansion; 11 undivided smooth lamellae under longest fingers, 12 to 13 under longest toe; (male with eight preanal pores in a curving or broadly angular series). Underside of upper part of arm and posterior part of thigh with fine granules; remainder of limbs with imbricate scales, many of those on legs, at least, being keeled and trihedral in shape.

Color in life: Above somewhat lavender-brown to grayish; an indistinct dorsolateral series of 17 pinkish, buff, or yellowish dots beginning at occiput and extending to tip of tail; venter with a dull yellowish wash; tail gray below, heavily flecked with brown. Occiput with two or three curving dark marks; body with numerous scattered black spots; an irregular dark area on postorbital region; sides flecked with black; tail with blackish spots which toward end tend to form transverse bands in front and behind yellow spots which themselves form bands near the tail tip; supra- and infra-labials cream with dark spots; a few dark markings on head.

Measurements in mm. of *Phyllodactylus siamensis*

NUMBER†	36084	36033	34978	34979	496
Snout to vent.	53	48	50	46	45
Tail.	52.5*	51*	47*	50.3	36*
Snout tip to arm insertion.	21	19	21.2	18	17.8
Axilla to groin.	24	22.5	24	22.5	22
Width of head.	10.2	10	10.8	9	10
Length of head.	16	14.2	15.2	15	15.2
Arm.	16	15.8	15.2	13	14
Leg.	21	20.6	21.4	18.6	19

†36084, 36033, Kaeng Pang Tao, Chiang Mai; 34978, 34979, Nong Boa Lumpoo, Loei; 496, Songkhla, Songkhla.

* Tail regenerated.

Distribution: This widespread species appears to be distributed over the entire country with the exception of high mountainous areas. Malcolm Smith has reported the species as far south as 10° lat. Whether its distribution has been facilitated towards the south by the presence of the railway as suggested by Dr. Smith may be doubted since it occurs on islands in the Gulf of Siam. However, the southernmost record (my own) at Songkla (latitude 7°) is from a point only about 200 meters from the railway. The species occurs in South Annam and if *burmanicus* is correctly synonymized here, it is also to be found in Burma.

Remarks: Differences in various populations of *siamensis*, while not great are such that a population may be recognizable on the basis of certain small scale or marking characteristics.

Phyllodactylus melanostictus Taylor

FIG. 14

Phyllodactylus melanostictus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 215-218, fig. 3. Type-locality, Mauk Lek Road-Camp, Friendship Highway, Sara Buri (practically on border of Sara Buri and adjoining province, Nakhon Ratchasima).

Diagnosis: Differs from *Phyllodactylus siamensis* in having a black stripe from tip to snout through eye to shoulder where it widens and continues along side of body and then narrows on tail. Dorsal spots if present very small, arranged in four longitudinal lines; a series of small dots on dorsal part of tail; arms and legs colored like sides of body; no white rings on tail.

Rows of enlarged trihedral or keeled tubercles present, median rows smaller than other rows, separated by three rows of small granules; next two rows separated by one row of granules; nine preanal pores in males.

Description of type: Rostral large bordering nostril, subquad-rangular, wider than high, with a median entrant suture in upper mesial part; a pair of enlarged internasals forming a straight median suture, and forming part of border of nostril; behind internasals another slightly enlarged pair of scales; first labial and two tiny postnasals form remainder of border of nostril; 29 scales in a row across head between edges of eyelids, and 28 scales in a row across snout between posterior edges of third labials; scales on snout slightly larger than those on interocular and occipital regions; granules in temporal areas slightly larger, with some still larger scales intermixed. Nine supralabials, seventh directly below pupil of eye; seven infralabials, fifth below pupil of eye; auricular-opening small, little larger than an internasal scale; mental with larger labial border than rostral, its posterior sides forming a right angle; a median pair of enlarged postmentals, each followed by two smaller widely separated pairs of scales; granules on chin and throat very small, subequal.

Dorsum covered with rows of trihedral or bluntly keeled tubercles, two rows near middle separated by three rows of small granules; next row separated from these by an irregular row of granules; subsequent rows contiguous or with only a few scattered granules between them; about ten or eleven rows on sides and dorsum but there is no distinct line of demarcation between these and flat cycloid scales of venter; latter scales in about 22 rows. A curving row of nine preanal pores; subcaudals enlarged, widened. Two postanal swellings indicate position of hemipenes; two rounded tubercles arising from each swelling. Limbs well developed, each digit with paired leaflike lamellae at tip, between which may be seen a small retractile claw; when limbs are adpressed, toe reaches halfway to elbow. Ten lamellae under longest fingers; fifteen under fourth toes, distal one usually divided. Segments of

tail distinct each segment with three or four transverse rows of scales arranged in whorls; posterior row with at least four enlarged keeled scales; on underside of each whorl, two subcaudals, anterior the larger (a total of about 30 segments in a complete tail).

Color in life: Above lavender-gray, top of head lighter, mottled with some darker color; a moderately distinct cream-white stripe from tip of snout through eye, disappearing on shoulder; bordering this below a black stripe extending from tip of snout onto tail, widening on sides and less distinct; labials and side of neck below stripe, white. Chin, throat, and venter white but under a lens fine

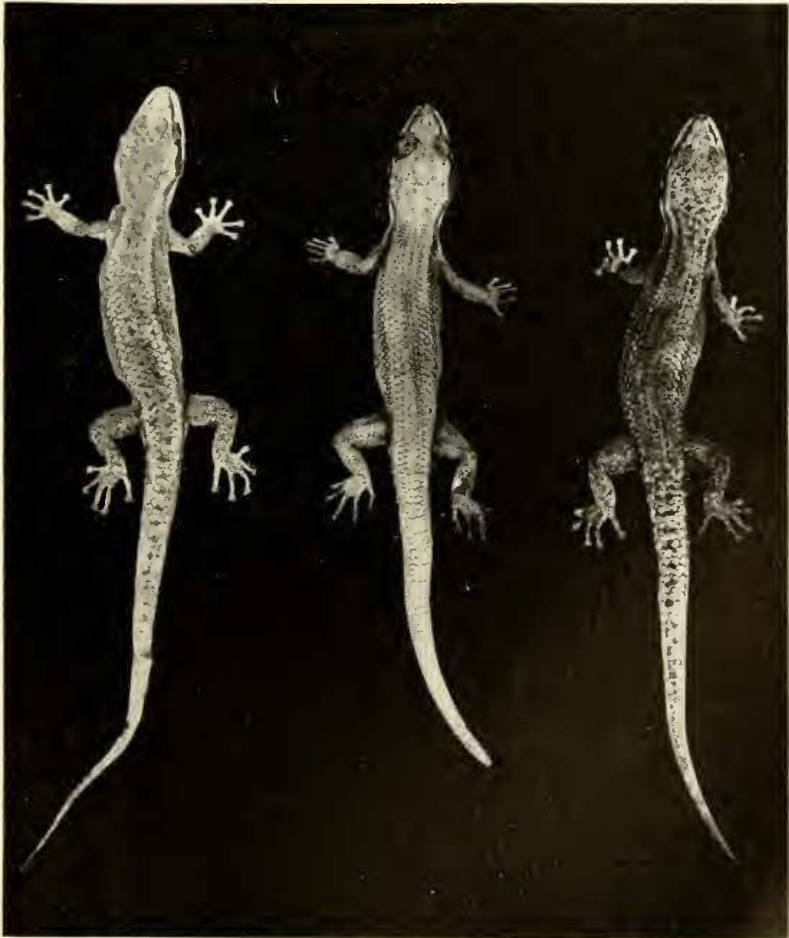


FIG. 14.—*Phyllodactylus melanostictus* Taylor. Fig. from Taylor, Univ. Kansas Sci. Bull., vol. 42, 1962, fig. no. 3.

pigmentation evident, less on chin than on venter; latter half of tail regenerated; basal part with a series of black spots marking segments.

Measurement in mm. (of type, No. 33333 ♂): Snout to vent, 42.5; tail, 54.5; total length, 97; snout to arm-insertion, 18.5; axilla to groin, 19; arm, 12; leg, 17; head width, 8.2; head length, 12.8.

Variation: The following variation is evident: No. 33334: The dorsum is lighter than in the type and the stripe on the side of the body is dimly evident. The entire tail has only vague lines marking the segments. There are nine preanal pores. There is no spotting or reticulation on head or body except two or three dark spots on labials.

No. 33331 ♀: The dorsolateral light stripes can be traced to tail as a series of dots. The pigment on the back is segregated into dark flecks forming four fine broken lines while the median line is nearly as light as the dorsolateral line. The head has numerous brown-lavender flecks. The labials have more distinct spotting, and the subcaudal region is darker.

No. 33332 ♀ resembles No. 33334. The tail is missing, and the lateral body stripe is more distinct.

Remarks: The specimens were taken from under logs or boards on wet earth. *Phyllodactylus siamensis* was taken less than 300 meters away. All specimens are from Muak Lek Road-Camp, near the town of Muak Lek, on the Friendship Highway, and actually less than three hundred yards from the boundary between the provinces of Sara Buri and Nakhon Ratchasima (Korat).

Variation: The type and paratypes are all generally similar as regards color and markings.

Distribution: It would appear that this form has originated and is still confined to the central mountain range in Sara Buri, and Nakhon Ratchasima provinces. This range is sometimes known as the Dong Paya Fai Mts. This area is also the home of such endemic species as *Riopa koratensis*, *Cyrtodactylus angularis*, *Riopa parietalis*, etc.

Genus HEMIDACTYLUS Oken

Hemidactylus Oken, Isis, 1817, p. 1183 (type of genus, *Gecko tuberculatus* = *Hemidactylus mabouia*).

Diagnosis: Relatively small species, the digits having widened lamellae divided mesially below on proximal part, all bearing clawed distal phalanges arising angularly from widened portion of

digit; digits without webs. Most species with small granular scales sometimes intermixed with larger tubercular granules; pupil vertical; preanal and/or femoral pores.

While the genus has some 70 species and is widespread in Asia, Africa, and Polynesia, the genus is represented in Thailand by only two species. These are *Hemidactylus frenatus*, an ubiquitous species, one of the two commonest "chinchooks" in Thailand, and equally common in trees and houses. The second is *Hemidactylus garnotii*, a widely distributed forest form, and more rarely a domestic species, that has a preponderance of females, the males being exceedingly rare. Dr. Malcolm Smith (1935) states that he has seen more than 100 specimens and has never seen a male. The species is rarely to be found in houses in Thailand. However, I took one at Khao Chong, Trang, in a forest rest-house, and several in a dwelling house in northern Thailand. *Hemidactylus frenatus* has been accidentally transported to Acapulco, Mexico (probably from the Philippines in Spanish times), and is now rapidly becoming distributed along the highways. It is presumably confined to houses, since I have never found the species in forested areas in Mexico, and presume that it cannot compete with the forest geckoes or other lizards.

KEY TO THAI SPECIES OF HEMIDACTYLUS

- Tail not or scarcely flattened, with whorls of erect tubercular spines on each segment; without lateral denticulations. Males as numerous as females *frenatus*
 Tail flattened, with flat imbricating scales, lacking erect tubercular spines; edges of tail denticulated. Males unknown in Thailand *garnotii*

Hemidactylus frenatus Schlegel, in Duméril and Bibron

FIG. 15

Hemidactylus frenatus Schlegel, in Duméril and Bibron, *Erpétologie Générale*, vol. 3, 1836 (type-locality, Java); Günther, *The reptiles of British India*, 1864, p. 161; Boulenger, *Catalogue of the lizards in the British Museum*, 2nd ed., vol. 1, p. 120; *Fauna of British India, including Ceylon and Burma*; Reptilia and Batrachia, 1890, p. 85; Flower, *Proc. Zool. Soc. London*, 1899, p. 628; Mocquard, *Les reptiles de l'Indo-Chine*, 1907, p. 29; Smith, *Journ. Nat. Hist. Soc. Siam*, vol. 1, no. 4, Dec. 1915, p. 238 ("Klong Yai"); *ibid.*, vol. 2, no. 1, June 1916, p. 52 (common almost everywhere); *The fauna of British India including Ceylon and Burma*; Reptilia and Amphibia; vol. 2, Sauria, 1935, pp. 95, 96, fig. 29. (The literature list of this species is very extensive. Only a few titles are given.)

Diagnosis: Body covered with small granules intermixed with a few scattered rounded smooth or feebly keeled, conical tubercles; male with a continuous series of preanofemoral pores, 14-19 on each

side; two pairs of postmentals, the outer pair nearly as large as inner, both touching labials; whorls of elevated spiny tubercles on tail.

Description of species (from No. 33715, Chiang Mai): Head slightly distinct from neck; rostral quadrangular, its width (2.75 mm.) much wider than high (1.8 mm.); a median suture in upper part (1.1 mm.), bordered laterally by first supralabial and mesially by two supranasals and a median internasal; nostril surrounded by rostral, supranasal, two postnasals, and first supralabial, its rim somewhat elevated; 12-12 supralabials, last three small, followed by ten or eleven granules to mouth-angle; eight or nine infralabials; mental triangular with a labial border larger than that of rostral; two pairs of chinshields, first forming suture behind mental; second chinshields border infralabials but separated behind first pair by five rows of granular scales; scales following second pair somewhat enlarged; a shallow frontal concavity extending back and onto occiput; auricular opening diagonal (1.7 mm. long), its distance from orbit (5.5 mm.) less than distance from orbit to tip of snout (6.5 mm.); diameter of orbit four millimeters; 21 scales across snout between second labials, 41 between fifth labials; scales on snout, on side of neck and body granular, subconical, juxtaposed, larger than granules in interorbital, occipital, and median dorsal areas; back with two rows of larger flat tubercles separated by four rows of fine granules; dorsolaterally two similar irregular rows of larger tubercles and a few scattered ones; segments of tail well marked, each limited by a whorl of six strong elevated spiny tubercles, the ventrolateral series largest; each whorl with ten or eleven rows of subcycloid granular scales imbricating somewhat; extreme tip of tail regenerated; subcaudal scales except at base of tail transversely widened into plates, two associated with each segment. Scales on chin small, juxtaposed; scales on throat, breast, venter and under thighs larger, cycloid, imbricate, but not entirely uniform in size; two indistinct ventrolateral folds with about 32 rows of scales between. A continuous row of 29 femoropreanal pores 14(15) on each side, median pores largest.

Digits unwebbed, with proximal parts covered below with widened, slightly diagonal lamellae, five under inner (smallest) finger, seven or eight under others, all paired except distal and most proximal ones; the two distal phalanges (with claws) compressed, elevated at an angle, reaching forward from tip of widened part.

Toes unwebbed, with similar lamellae, five on shortest, nine

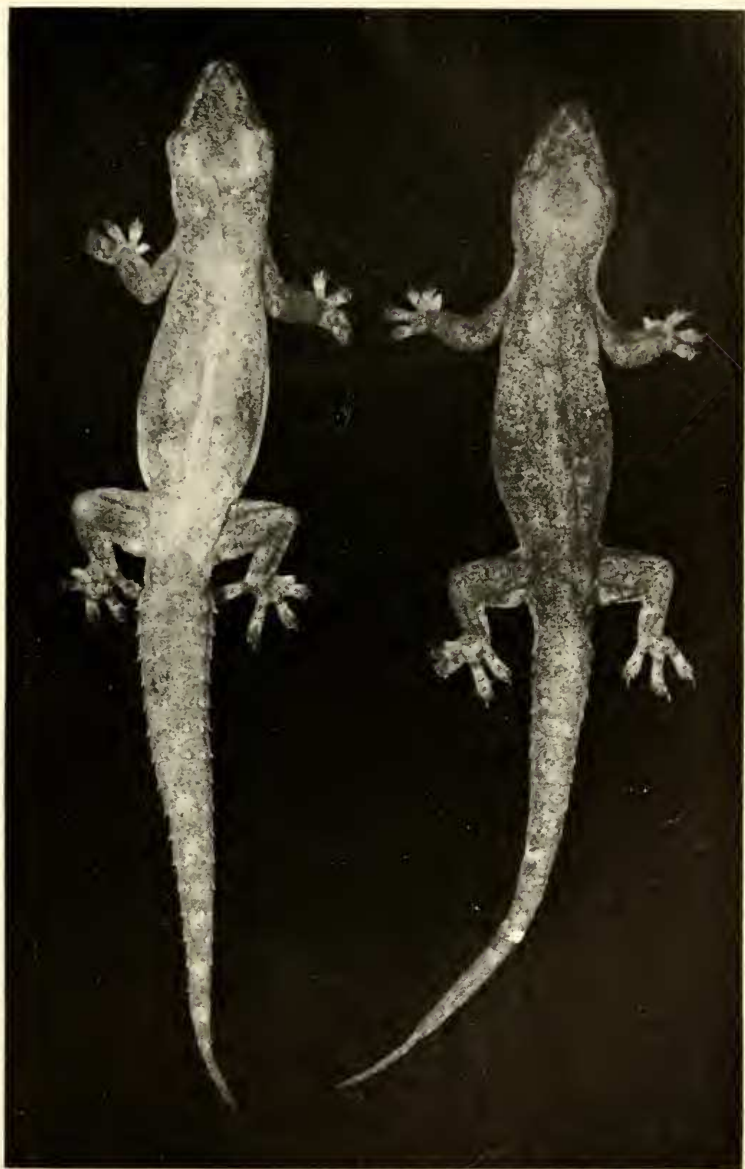


FIG. 15.—*Hemidactylus frenatus* Schlegel, in Duméril and Bibron. Left figure, No. 33715. Chiang Mai, Chiang Mai province, Thailand. Actual length, 119.5 mm. Right figure, No. 33719, same locality. Actual length, 120 mm.

on longest toes; hand and foot with larger imbricating cycloid scales on upper surface, and on anterior face of arm.

Color: The color brownish gray clouded or flecked with darker gray; yellowish or yellowish-white on ventral surfaces; lamellae dark gray to lavender.

Measurements in mm.: Snout to vent, 57; tail, 62.5; width of head, 12; length of head, 16.5; snout to arm-insertion, 21; axilla to groin, 28; arm, 16; leg, 21.

Variation: Living specimens usually have a fairly distinct color pattern often consisting of a dark gray stripe on side of head, neck, and body; a tail banded in dark and light gray; a dorsolateral dark stripe, somewhat sinuous anteriorly, enclosing a series of discernible light gray spots or dashes. A similar median stripe usually also present. The tail is somewhat pigmented below. There are variations in dorsal squamation, the two principle ones being:

1. Two median rows of distinct widely spaced tubercles, the two dorsolateral ones somewhat irregular.
2. No median rows present, the lateral tubercles reduced to one row with a few scales representing a second.

These may occur in the same population and both extend from the northern to the extreme southern part of Thailand. The character of the femoral pores differ, some specimens having them cut across the scale as an elongate slit. In others the scale pores may be oval, or the median ones slitlike, the others rounded. The number of femoropreanal pores varies between 28 and 36. Occasional specimens have a small third pair of chinshields.

Distribution: Found everywhere in Thailand except perhaps in high mountains. The species is widespread in south and eastern Asia, in the Indo-Australian Archipelago, the Philippines, some oceanic islands in the Western Pacific and Indian Ocean, and in east Africa.

Remarks: Eggs of *Hemidactylus frenatus* are usually placed under bark stuck on tree trunks or placed in crannies in walls or other objects. When the young hatch they are dark blackish-brown in color with numerous bright golden spots arranged in a dorso-lateral line. Shortly after emerging from the brittle shell and after becoming dry, the epidermal skin becomes loose. The behavior of one young was observed. By rubbing its nose against some object the skin was rubbed loose and pushed back. Then the young animal turned its head back seizing the loose skin on the shoulder and breaking it. It then pulled it away and proceeded to eat it. This

was continued until all the skin was removed from body and limbs, and all of it consumed. Only that on the tail now remained. This was seized near the base and pulled wrong-side-out and left for some time hanging to the tip of the tail. Finally this was caught up and swallowed, finishing the task. The whole time consumed was approximately 12 minutes. Other young have been watched and the process of removing the loose skin was much the same except the order in which various portions were removed. This seems to constitute their first meal.

Hemidactylus garnotii Duméril and Bibron

FIG. 16

Hemidactylus garnotii Duméril and Bibron, *Erpétologie générale* . . . vol. 3, 1836, pp. 368-369 (type-locality, Tahiti); Boulenger, *Proc. Zool. Soc. London*, 1883, p. 118, pl. 21, fig. 1; *Catalogue of the lizards in the British Museum*, vol. 1, 1885, p. 141; *The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia*, 1890, p. 94; *Ann. Mus. Civ. Genova*, ser. 2, vol. 13, 1893, p. 315; Stejneger, *Proc. U. S. Nat. Mus.*, vol. 21, 1899, p. 792, fig.; Laidlaw, *Proc. Zool. Soc. London*, vol. 1, 1901, p. 305; Annandale, *Ann. Mag. Nat. Hist.*, ser. 7, vol. 15, 1905, p. 30; M. Smith, *Journ. Nat. Hist. Soc. Siam*, vol. 6, 1923, pp. 196-197 (Hainan); *Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia*, vol. 2, Sauria, 1935, pp. 100-101.

Doryura gaudama Theobald, *Journ. Linnean Soc. London*, vol. 10, 1868, p. 30 (type-locality, Tonghu [valle Sittangensi], Burma).

Hemidactylus gaudama: Taylor, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 86, 1934, p. 288.

Diagnosis: The slender compressed joint of inner digits at least half as long as dilated portion; enlarged dorsal tubercles along flanks, rounded, moundlike, or conical; tail flat below, edges finely denticulated; segments rather distinctly marked; median subcaudals widened; second pair of chinshield separated from infralabials normally.

Description of species (from No. 36134, Chiang Mai): Head rather slender, body flattened; rostral not quite twice as wide as high, upper part tending to flatten out on top of snout; a median suture passes forward from upper edge nearly half way across scale; rostral followed by a labial on each side, and two supranasals separated by one scale; nostril surrounded by rostral, first labial, supranasal, and two small postnasals; eleven supralabials followed to angle of mouth by five or six small scales; about 43 scales in a line between back edge of fifth supralabials across snout, those on sides a little the larger; some larger scales bordering supralabials; about 42 small granules between outer edges of eyelids counting in a line crossing at middle of eyelids; mental with a labial border about equal to that of rostral, followed by two pairs of chinshields, anterior

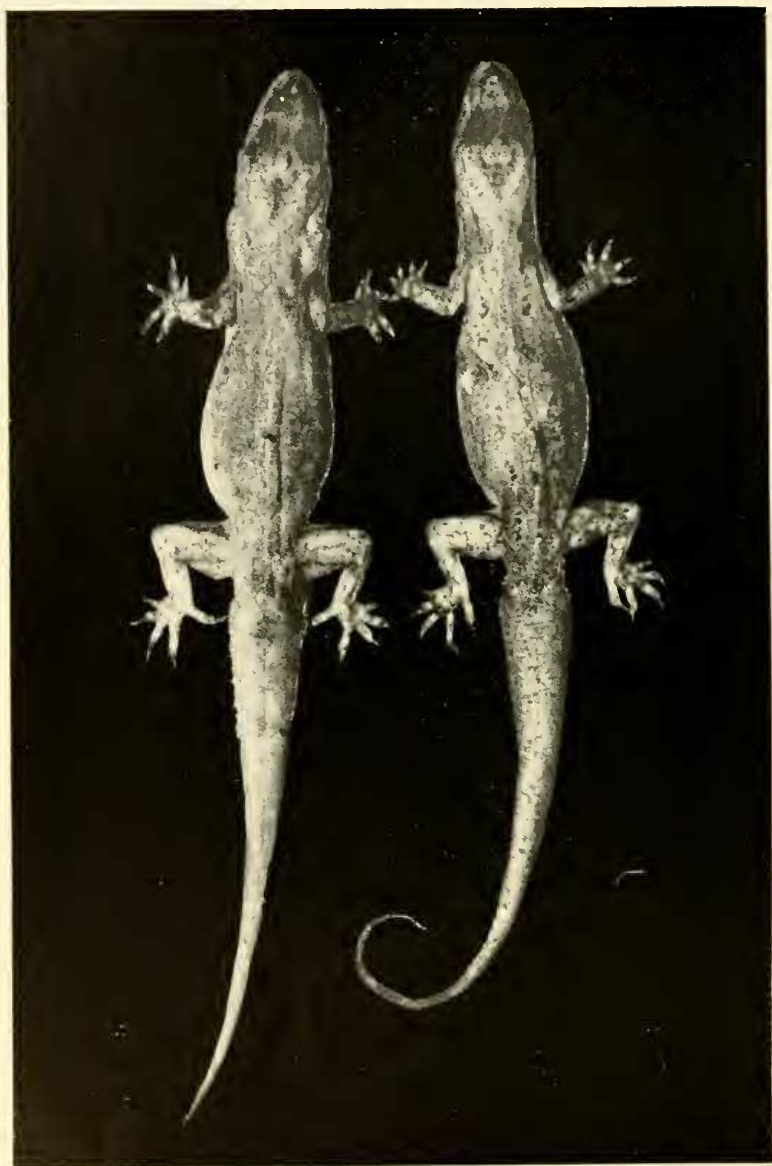


FIG. 16.—*Hemidactylus garnotii* Duméril and Bibron. Left figure, No. 36134, Doi Suthep, Chiang Mai province; total length, 119.5 mm. Right figure, same locality?; total length, 122 mm.

only touching labials and forming a mutual suture less than half their length; second pair separated from supralabials by a row of small scales and separated from each other by two small scales; 9-10 infralabials; one or two irregular rows of slightly enlarged scales border infralabials; diameter of orbit equal or slightly less than its distance from nostril.

Scales on snout larger than occipital scales or those on middle of dorsum; on sides of body scales larger than on dorsum with numerous scattered tubercles that are somewhat larger than other scales, most prominent dorsolaterally on latter half of body; two prominent ventrolateral glandular folds; between these, scales in about 30 rows, cycloid, imbricating, their posterior edges distinctly serrate; small granules on chin, becoming imbricate on throat.

Tail flattened below, elevated above, edged with a fringe of scales, every fourth or fifth one larger marking the segments of tail; scales above somewhat cycloid imbricating; strongly widened subcaudal series, usually two to each segment; regenerated tail also with widened scales but fringe scales are nearly uniform; fingers and toes widened with compressed terminal portion rising above the widened lamellar portion, all with claws; paired lamellae under fingers except basal ones may be single, as is the terminal one at distal end; toes with similar lamellae; a slight web-remnant present; inner finger and toe short, narrow, with a well-developed distal compressed joint with claw. A series of femoral scales extending onto preanal region; ten scales of femoral region on each side bear pits or perforations, these series separated by eight intervening preanal scales that lack pits.

The area at base of subcaudal region swollen with a single small lateral tubercle on each side.

Color: Above uniform fawn to gray fawn; venter creamy yellow; lamellae dark under digits. There are no pigment dots on ventral scales save a few on infralabials and on outer subcaudals.

Measurements in mm. of Nos. 36134 ♀ and 35978 ♀: Snout to vent, 57, 64; tail, 62.5, 82; snout to arm-insertion, 22.6, 25; axilla to groin, 28, 28; width of head, 11, 13; length of head, 16, 16.3; arm, 18, 20; leg, 21, 25.

Variation: Most specimens have a slight frontal concavity, in others this is scarcely indicated. One specimen from Chiang Mai has the dorsal parts brownish gray with 9 or 10 transverse series of rounded whitish spots tending to form two longitudinal lines as well. One or two rows may continue on the tail. Arms and legs

likewise marked with bands of white marks. A specimen from Kaeng Pang Tao has an indistinct lateral band of dark gray and three dorsal series of elongate spots forming three broken dorsal stripes; some spots on basal part of tail white, the latter two thirds is distinctly banded in light and dark gray bands. This specimen has both pairs of chinshields touching labials.

Specimens from Trang have whitish spots on the body, and on one the tail is banded.

Some specimens show large deposits of calcium about the ear region. One specimen from Trang is badly infested with segmented worms. These are subcutaneous their length being from ten to 16 millimeters.

Distribution: It seems probable that there has been some confusion with regards the identification of this species. The absence of male specimens from collections can scarcely be explained save on the possibility of parthenogenesis which seems too improbable to be considered. The type locality of *garnotii* is Tahiti.

In Thailand I have taken specimens from the provinces of Chiang Mai, and Trang.

Taylor (1934) reported the species from Chiang Mai under the name of *Hemidactylus gaudama*.

Outside of Thailand the species (presuming the Thailand form has been correctly identified with *garnotii*) is widespread in Malaya, Indo-Australian Archipelago, and to Tahiti, its type locality.

Remarks: I have found no males of this species in Thailand. Malcolm Smith (1935) reports that he has seen more than 100 Thai specimens of this species but has never seen a male.

It would appear that *Doryura gaudama* Theobald was based on a male having 38 femoral pores, 19 on each side in a slightly curved series. I have seen a male from the Philippines with pores.

Genus PLATYURUS Oken

Platyurus Oken, Algem. Naturgesch, vol. 6, 1836, p. 641 (type-species *Hemidactylus marginatus*).

Cosymbotus Fitzinger, Systema Reptilium, 1843, pp. 19, 104 (type-species *Hemidactylus platyurus*).

Mimetozone Boulenger, Proc. Zool. Soc. London, 1896, p. 767 (type-species *floweri*).

The name *Platyurus* for this genus of lizards was used by Oken in 1836 and so far as known is the oldest. However, because of the similarity of this name to *Platurus* of Latreille it was rejected.* Fitzinger proposed the name *Cosymbotus* in 1843 in Systema rep-

* See Stejneger, Bull. 58, U. S. Nat. Mus., 1907, p. 178.

tillium (type *platyurus*) and this available name was used by many authors. However, Malcolm Smith revived *Platyurus* for this genus in 1935.**

The present nomenclatorial rules admit generic names that have the same meanings, derived from the same Greek or Latin words providing they differ by a single letter. Thus the name *Platyurus* will stand.

Diagnosis: Digits webbed, the terminal phalanges (with claws) arising free from middle of widened portion of digits; basal phalanges with lamellae, paired, slightly diagonal, except first and last which are single; no digits without terminal phalanges and claw; a cutaneous fringe from axilla to groin and on sides of tail; no tubercles on body or tail; subcaudals widened.

The genus is widely distributed, probably very largely through man's agency since the species seems to prefer human dwellings.

The differences between the genera *Platyurus* Oken and *Mimetozone* Boulenger appear to be differences chiefly of degree and consequently the two are here treated as a single genus with two species occurring in Thailand.

KEY TO THAI SPECIES OF PLATYURUS

- Body with a narrow lateral fringe or skin-flap from axilla to groin; no fringe on side of head and neck; tail with a narrow denticulated fringe *platyurus*
 Body with a broad lateral fringe from axilla to groin; a fringe on side of head; tail with a broad denticulated fringe *craspedotus*

Platyurus platyurus (Schneider)

FIG. 17

- Stellio platyurus* Schneider, Amphibiorum physiologiae specim., vol. 2, 1797, p. 30 (type-locality, unknown); Denksch. Akad. Munich, vol. 3, 1811, p. 62, pl. 1, fig. 3.
Nycteridium platyurus: Stoliczka, Proc. Asiat. Soc. Bengal, 1871, p. 194; Journ. Asiat. Soc. Bengal, 41, (2), 1872, p. 103.
Hemidactylus platyurus: Boulenger, Catalogue of the lizards of the British Museum, 2nd Ed., vol. 1, 1885, p. 143; The fauna of British India, . . . Reptilia and Batrachia, 1890, p. 95; Flower, Proc. Zool. Soc. London, 1899, p. 629; De Rooij, Reptiles of the Indo-Australian Archipelago, vol. 1, Lacertilia, Chelonia and Emydosauria, 1915, pp. 34-36, figs. 23, 24; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 53, and no. 2, Dec. 1916, p. 152 (Maprit, and Klong Bang Lai, Chumphon) ("Common almost everywhere").
Cosymbotus platyurus: M. Smith, Bull. Raffles Mus., no. 3, Apr. 1930, p. 19; Taylor, The lizards of the Philippine Islands, 1922, p. 59; Deraniyagala, Ceylon Journ. Sci., sec. B, vol. 16, 1932, p. 306; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, p. 1082 (Rat Buri province).
Platyurus platyurus: M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 102-103.

** Fauna of British India . . . vol. 2, Sauria, p. 102.

Diagnosis: Digits webbed and dilated; lamellae under toes divided; distal phalanges long, slender (with claws) arising at an angle from above widened portion of digit-tip; two pairs of postmental chinshields, second pair lateral to larger inner pair; a distinct skin-fringe from axilla to groin covered with small scales; a broad cutaneous fold along back edge of leg; 16-20 preanofemoral pores in a continuous series on each side, meeting mesially.

Description of species (from No. 35983, Chiang Mai, city): Head moderately slender; width of rostral (2.4 mm.) much less than twice height (1.6 mm.); bordered by one labial, laterally and by a pair of supranasals and a small internasal posteriorly; nostril surrounded by rostral, supranasal, first supralabial and two postnasals; 12 supralabials; eight or nine infralabials; mental rather large, its labial border equal to that of rostral, followed by a median pair of chinshields, flanked by a second pair; first chinshields in contact for about half their length, second pair separated by two or three small scales.

Scales on snout juxtaposed, slightly conical, larger than other scales on dorsal and lateral parts of body; scales on chin cycloid juxtaposed, becoming imbricate on throat and breast; a lateral fringe on sides of body from axilla to groin, its width two millimeters at widest point; scales on venter larger, cycloid, imbricate, their back edges often with a fine serration; front and ventral surface of femur and tibia with cycloid imbricate scales equal in size to scales on venter; posterior row of scales on underside of femora bear pores (in male), totalling about 36; no large tubercles on postanal swellings in male or female; a fringe on posterior part of thigh and tibia; a slight lateral fringe on sides of tail; subcaudal scales, except at base of tail, widened, two to each segment; outer edge of tail serrate, segments marked by a pair of larger denticulate spines, one on each side, in the fringe on tail.

Digits of hands and feet nearly half webbed, except between the two outer toes where there is less web; digits widened with paired lamellae below; distal phalanges (with claws) arise from middle of expanded tip at an angle and extend forward beyond widened part, not attached to it by a web; inner digits small, but distal phalanges and claws present; six paired lamellae under most of longer digits; the distal and often proximal one, single.

Color: Above varying shades of gray; usually a pattern is visible (it can appear and disappear in living specimens) consisting of a

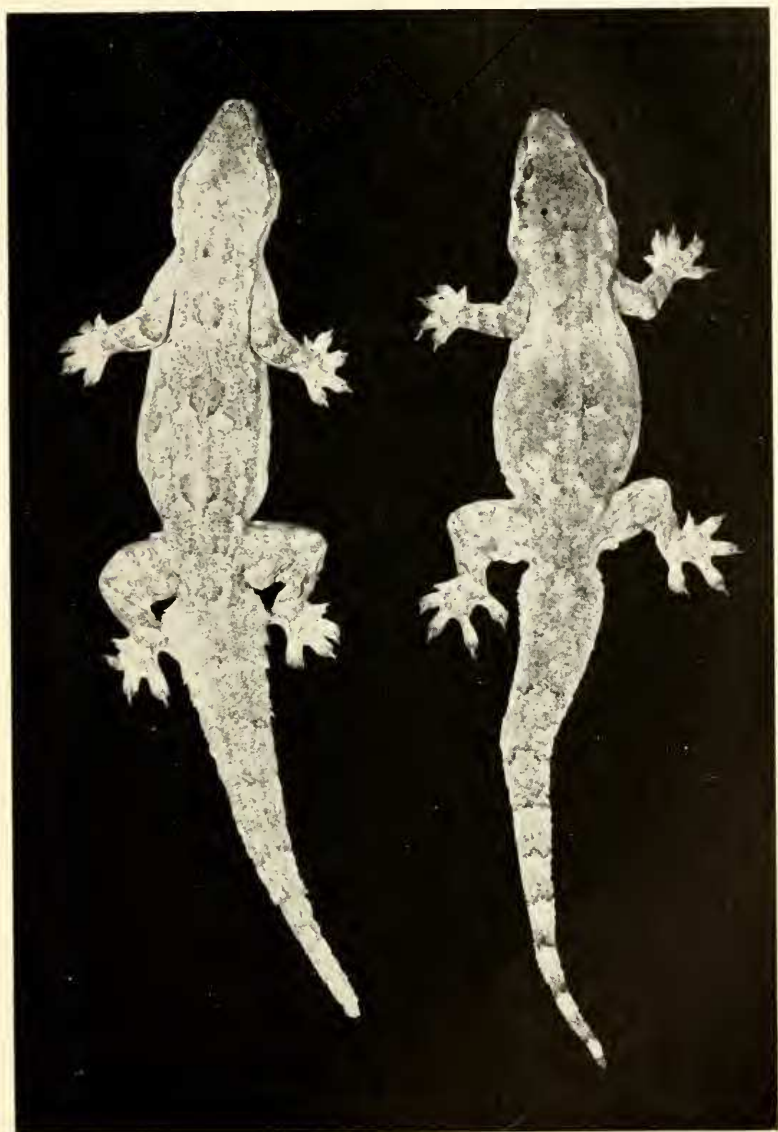


FIG. 17.—*Platyurus platyurus* (Schneider). Left figure, No. 34449 ♂, Pattani, Pattani province Thailand. Actual length, 111 mm. Right figure, No. 33704 ♀, Chiang Mai, Chiang Mai province, Thailand. Actual length, 118 mm.

series of four darker median spots sometimes divided by a light-gray line, the spots tending to connect laterally with an irregular somewhat less dark marking. There are transverse grayish marks on arms and less distinct ones on legs. An indistinct darker band along side of snout, head, and neck, passing above arm to groin. Tail dimly banded with narrow dark-gray and wider light-gray bands indicated on undersurface only on the fringe; chin, venter, and subcaudal region cream with some yellowish wash.

Measurements in mm.: Snout to vent, 57; tail, 63; width of head, 12.4; length of head, 15; snout to arm-insertion, 22.6; axilla to groin, 27; arm, 18; leg, 21.

Variation: The sides of the median dark spots are intensified in some specimens and the series on each side simulates a broken stripe. The top of the head is usually smoky gray. Older specimens have wider, somewhat plumper tails. However, the undersurface of all are flat. The tails are very fragile; about one out of ten has a tail that is complete.

The numbers of femoral pores varies from 32-38, the higher numbers being most frequent. The pores are transversely elongate forming slits across the scales. The series on each side are curved laterally forming a median angle.

Many specimens have large deposits of calcium (otoliths) about the auricular opening.

The color varies, especially in preserved specimens, many appearing cloudy gray with scarcely any pattern indicated.

Distribution: The species is ubiquitous in Thailand, probably the most common house-gecko or *chinchook* in the country.

Outside of Thailand it has been found in Ceylon, India, Sikkim, South China, Malaya, and it occurs widely in the Indo-Australian Archipelago, and the Philippines.

Remarks: This species lays two eggs.

Platyurus craspedotus (Mocquard)

FIG. 18

Hemidactylus craspedotus Mocquard, Le Naturaliste, 1890, p. 144 (type-locality Kina Balu, British North Borneo).

Mimetozone floweri Boulenger, Proc. Zool. Soc. London, 1896, p. 767 (type-locality, "Crag" Hotel, Penang Hill, 2200 ft., Malaya); A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 46.

P[latyrus] craspedotus: M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 102.

Diagnosis: Trace of a small dermal fringe on side of head; strong dermal flaps bordering limbs and sides of body; tail with a broad

denticulate fringe; median subcaudals widened; preanofemoral pores, 16-19 on each side separated mesially by several scales.

Description of species (from EHT-HMS No. 3871, Khao Chong Forest Experiment Station, Trang provinces, Thailand): Body and limbs depressed; head scarcely distinct from neck; snout

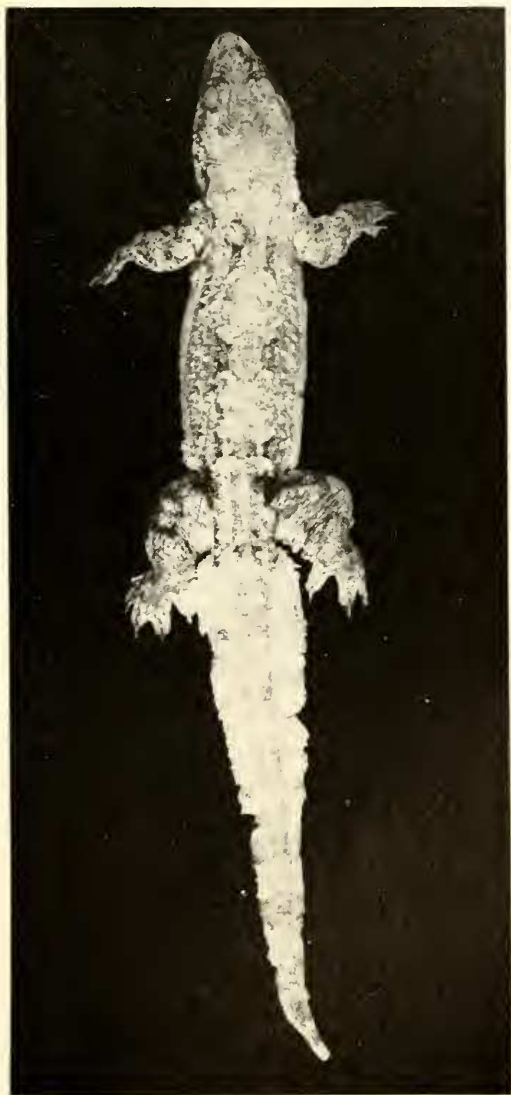


FIG. 18.—*Platyurus craspedotus* (Mocquard). EHT-HMS No. 3871, Khao Chong Forest Experiment Station, Trang province, Thailand. Actual length, 127.5 mm.

obtusely pointed, longer than distance between eye- and ear-opening; rostral two thirds as high as wide, bordered posteriorly by first supralabials and two supranasals; a suture enters rostral from above and continues to a dorsal depression in the scale; nostril surrounded by rostral, supranasal, first labial, and two postnasals, lower the larger; snout pinched-in somewhat behind nostrils; a deep frontal depression more or less connected with the occipital depression; 29 or 30 scales across snout between second supralabials; about 56 scales across snout between fifth supralabials; eleven supralabials, last two small, and beyond these there are minute scales bordering mouth to angle but near these there is a series of five larger scales; eight infralabials, anterior ones very large; mental large triangular; a pair of large median chinshields forming a median suture; second chinshields separated by these but also in contact with infralabials; third chinshields small, separated by seven scales from each other, from infralabials by a single scale.

Snout covered with flat juxtaposed scales a little larger than those in occipital region but practically same as those on dorsum; about 14 irregular rows of enlarged, rounded conical tubercles on dorsum, some extending as far as rostral, those in occipital region smallest; tail showing distinct segments, each basal segment with about 10 rows of transverse scales and with a pair of large flattened tubercles; on sides of tail a dermal fringe edged with numerous denticulate scales larger than dorsal caudals; scales on chin and throat small juxtaposed; ventral surface of body with about 70 rows of scales, those hidden under lateral dermal flaps small, others subcircular, subimbricate; at least those on anterior part of body serrate on posterior edge; in femoral region an elongate series of large scales, each bearing a lunate or oval preanofemoral pore, the series separated by five scales mesially, sixteen on each side; a much-enlarged median series of about 50 subcaudal scales; scales at base small; a lateral denticulate flap on each side of tail; no spines on hemipenial swelling on underside of base of tail.

A lateral skin-fold below horizontal ear-opening; a skin-fold on front and back of arm, and also on leg; digits about two-thirds webbed; all digits with a double row of lamellae; distal phalanges compressed, slender, elevated, arising from widened portion of digit; all digits clawed.

Color: Above generally gray, speckled with paired quadrangular brown spots; a dark line from eye back to elbow; one or two dark longitudinal lines along sides of body; lateral membrane on body

whitish below, brown-spotted above; tail more or less banded posteriorly. Head with indefinite brownish marks; chin, throat, and labials with small brown flecks; venter nearly uniformly white (yellow in life).

Measurements in mm.: Snout to vent, 62; tail, 65.5 (tip regenerated); total length, 127.5; width of tail at base, 11; width of head, 15; length of head, 16.5; snout to arm-insertion, 24; axilla to groin, 28; arm, 19; leg, 22.

Variation: Two other specimens are at hand: B.M. No. 1926.12.7.7. (6157) from "Foot of Ronpibun Hill, Nakhon Si Thammarat, Thailand; No. 1930.10.9.2. Perak, Malaya. The first has 60 subcaudals, 19-20 preanofemoral pores separated by four scales: scattered tubercles on the frontal and snout areas; greatest width of lateral body fringe 3 mm. The second specimen is a female, and differs in the absence of the preanofemoral pores and while the scales on the snout are a little larger than body-scales the tubercles are absent on snout and occipital region. There are three or four larger scales on the anterior part of the supraocular region and tubercles are present over the dorsum.

In this specimen the mental is a little more elongate, the median chinshields forming a suture for about half their length.

Remarks: The wisdom of maintaining a separate genus for this species, as has been done in the past, is questionable. It agrees with *Platyurus platyurus* in almost if not all general characters. The differences are only differences of degree. Thus the lateral fringe is somewhat wider, the tail fringe wider, the fringe on limbs greater, the webbing between digits greater. There is even a small lateral fold indicated below the ear in *platyurus*. The general characters of the foot are the same. *Platyurus*, however, lacks the enlarged tubercles on dorsum and head.

The two genera were united by Malcolm Smith (1935). In this I concur.

Genus PEROPUS Wiegmann

Peropus Wiegmann, Nova Acta Acad. Caes. Leop.-Carol., vol. 17, 1835, p. 238 (type of genus, *mutilatus*).

Diagnosis: Digits free, or with a web at base of digits; median part of each widened, with paired lamellae on undersurface preceded by a single lamella. Distal phalanges of four outer digits on hand and foot slender, clawed, free, arising angularly from middle of widened portion; inner digits well developed usually with claw but lacking distal free phalanges; dorsal scales small, granular; sub-

caudals small or widened; pupil vertical; in males preanal and femoral pores present, usually in a continuous series.

There has been much confusion as to the proper generic name for this group of lizards. Stejneger (Proc. U. S. Nat. Mus., vol. 21, 1899, p. 796, and Bull. U. S. Nat. Mus., No. 58, 1907, pp. 180) has shown that the name *Peropus* of Lay and Bennett, for a genus of fishes, was not actually published until about 1840 and is antedated by *Peropus* Wiegmann by several years. Unless this can be successfully refuted the name *Peropus* must stand for this genus instead of *Gehyra*.

This species is domestic in habit and has been widely distributed by man. It occurs widely in South Asia, and has reached Australia, Polynesia, and even Mexico.

KEY TO SPECIES OF PEROPUS IN THAILAND

1. Subcaudal region with a median series of large transversely widened scales; dorsal body scales not distinctly conelike; pores variable 2
 Subcaudal region with several series of small scales not transversely widened; ten preanal pores on each side forming a continuous series, angular mesially, extending slightly on to femora . . . *laceratus*
2. Tail much widened behind vent 3
 Maximum width of tail not or but slightly wider than base, scales on dorsum small, flat, cycloid, imbricating, with a slight lateral caudal fringe, not or scarcely denticulate; 15-18 femoral and preanal pores continuous, angular mesially *angusticaudatus*
3. Femoropreanal pores lunate or oval, 15 to 20 on each side forming a doubly-curved, continuous series, angular mesially extending nearly entire length of femora; a pair of rather large supranasals in contact mesially; tail denticulate on sides *mutilatus*
 Femoropreanal pores eleven on each side, small, subcircular forming an angle mesially and reaching about halfway along femora; supranasal smaller, separated mesially; a slight caudal fringe, somewhat denticulate *fehlmanni*

Peropus laceratus Taylor

FIG. 19

Peropus laceratus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 218-221, fig. 4 (type-locality, Kanchanaburi, Kanchanaburi province, western Thailand).

Diagnosis: Preanal pores, 20, forming an angular series extending slightly onto femoral region; preanal area covered with enlarged, somewhat pointed scales, but scales on areas lateral to this on underside of femora scarcely half as large. About 48 scales in a line across venter between indistinct ventrolateral folds, scales pointed posteriorly rather than rounded; no web on hand or foot; ten labials to a point below median part of eye; tail distinctly

shorter than body, subcaudals not widened, median five or six rows similar to scales on venter; segmentation of tail not clearly indicated; dorsal scales very small, nearly uniform.

Description of type: Snout oval, with a frontal depression extending back between orbits to a shallow depression on occiput; areas in front of orbits distinctly swollen; rostral one and three-fourths times as wide as high, its median upper portion with a depression and an entrant groove from above; a pair of enlarged supranasals separated mesially by a small scale; nostril bordered by rostral, supranasal, first labial, and three small postnasals; 53 scales across snout at level of suture between fifth and sixth labial; twelve supralabials, tenth, or tenth and eleventh below middle of eye; a series of tiny scales from last supralabial to back of mouth-angle. Mental moderate, its border on mouth equal to that of rostral, forming a right angle with median pair of chinshields, each of which is pointed anteriorly and rounded behind; second pair of chinshields lateral to first, angular anteriorly, rounded behind; third chinshields small, followed by a row of slightly enlarged scales bordering infralabials; ten or eleven infralabials, ninth below eye; last followed by tiny scales to mouth-angle; chinshields somewhat raised and rounded across upper surface, with regular depressions between them; eye moderate; "eyelid" evident from the median lower edge of eye, running around the front and upper edge of eye; length of snout from orbit (5.5 mm.) greater than diameter of orbit (4 mm.).

Arm moderate, with an indistinct narrow web in front of elbow; all digits widened, the shortest with five, longest with seven paired lamellae and a single anterior one; lamellae following on narrow proximal portion of digit scalelike, paired or single (on outer part there may be as many as four rows of scales). From middle of upper surface of widened portion of digits, distal clawed joints arise nearly vertically or bend forward on all digits except inner finger which lacks the terminal phalanges but has a small claw.

Scales of dorsal and lateral surfaces of head and body very small, conelike tubercles varying somewhat in size on head but on body tending to form straight longitudinal and diagonal rows. Scales on venter in about 48 rows between the slight ventrolateral folds; scales imbricate, bluntly pointed, rather than rounded, in fairly straight longitudinal rows. In preanal region larger scales form a somewhat angular series bearing 20 preanal pores and some scales following these bear indistinct depressions; pore-scales followed by four shorter angular series in the region preceding vent; four or

five subcaudal scalerows, larger than adjoining scales but median series not widened transversely, the scales resembling those on venter. Segmentation of tail not or scarcely discernible.

No webs between digits on hand or foot; ear small, situated on a level with lower part of eye; tail thickened, widened near base.



FIG. 19.—*Peropus laceratus* Taylor. Type. From Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, No. 7, fig. no. 4.

Color: Above gray on back and sides, with small, darker gray spots of which there are about twenty on head: spots on body and sides a little larger, more widely scattered, with a double row of very indistinct rounded lighter spots on back; some darker spots on middle of limbs; undersurfaces of body cream to whitish yellow.

Measurements in mm.: Snout to vent, 55; tail, 38; total length, 93; width of head, 12; length of head, 15; tip of snout to arm-insertion, 18; axilla to groin, 25; arm, 17.5; leg, 21.

Variation: No. 33471, a young male topotypic paratype has the pore-scales forming a highly arched angular series, nine on each side, the median one almost separating the two mesial pore-scales that are normally in contact; the dorsal and lateral caudal scales form distinct transverse scalarows ventrally; the segments can be discerned since the last transverse row of subcaudal scales usually has one a little larger than the others.

A second young male (No. 33280 from Ang Hin, Chon Buri) has a similar series of pores but a median scale separates the two series of pore-scales. Another specimen, No. 33281 has lost all skin from the preanal area.

In markings, all are much the same except that the rounded lighter marks may be dimly present over entire dorsal and lateral surfaces of body.

Distribution: Known only from the type locality and Ang Hin, Chon Buri province. All were found under rocks or logs.

Remarks: In the type the widened basal part of the tail contains bony vertebrae; the distal portion (6 mm.) shows two regenerated areas, the last about two millimeters in length.

The skin, as in *Peropus mutilatus*, is extremely fragile, and the skin surface is badly broken. The type, a female, contains two large eggs.

Peropus angusticaudatus sp. nov.

FIG. 20

Type: No. 1035; Siracha, Chon Buri province southeastern Thailand; Edward H. Taylor coll. Apr. 15, 1960.

Paratypes: No. 1033, 1034, 1036, 1037, topotypes, same date and collector.

Diagnosis: Tail distinctly longer than head and body, not or scarcely widening beyond base, much attenuated distally; the hemipenial swellings in males with two small tubercles; edges of tail with a narrow non-denticulated fringe; tail not flattened below but

with a distinct rounded median ridge extending to near tip; male with a series of 15 to 18 large femoropreanal pores on each side.

Description of type: Rostral wider than high with a median straight entrant suture, and bordered on each side by one supralabial, nostril and a supranasal; supranasals quadrangular forming a mutual suture with each other; nostril surrounded by these scales and two small postnasals; a row of slightly larger scales behind supranasals; about 24 scales across snout between posterior edges of second supralabials; about 40 scales between back edge of fourth supralabials; about 33 scalerows between median edges of eyelids; seventh supralabial below middle of pupil followed by three very small supralabials, and a series of about eight granular scales to mouth-angle; mental moderate, as wide as rostral, shape of a quadrant, followed by a pair of chinshields wider anteriorly than posteriorly and flanked on each side by a second pair, narrower and shorter; third pair scarcely differentiated, separated from infralabials by one or two scales; eight or nine infralabials last three small, followed to angle of mouth, by five small granular scales; ear-opening small, its greatest diameter, (1.5 mm.) in diameter of orbit, (3.6 mm.) more than twice; areas immediately posterior to eyes swollen; scales on snout larger than granules of interorbital and occipital areas, or of the shoulder area between arms; body scales subequal, juxtaposed or slightly imbricate, those on sides a little larger than others, rows somewhat irregular; about 35 rows of cycloid, imbricate scales on venter, scales much larger than dorsal scales; scales small on chin, throat, and breast; a doubly curved series of 37 large transversely oval femoropreanal pores angular mesially extending to near distal end of femur; pore-scales preceded by several transverse curving rows of scales, and followed by another; hemipenial swellings relatively small with one or two very small lateral tubercular scales; base of tail relatively narrow, tail not widening suddenly (as in *P. mutilatus*).

Tail slender becoming greatly attenuated, terminating in a very fine tip. Tail not flattened below but with a median rounded slightly elevated ridge; tail somewhat elevated above the borders with a narrow fine nondenticulated fringe.

Fingers short, the outer basal portion widened with five or six lamella below, all divided except terminal; proximal joints with two or three rows of fine undifferentiated scales; a small web, at least between second and third and third and fourth fingers; distal joints arise and stand nearly erect from widened portion of digit on all

except inner finger which lacks distal portion entirely (the fifth finger of right hand is anomalous in also lacking the distal phalanges). I can find no claw on first finger. Toes similar to fingers; fourth and fifth longer than other toes; inner toe lacks distal phalanges but a claw is present. When limbs are adpressed they overlap length of fourth toe.

Color in life: Nearly uniform dark gray above on body, somewhat lighter on head, and darker lavender on tail with a suggestion of lighter bands distally; chin, throat, and venter yellowish-white but



FIG. 20.—*Peropus angusticaudatus* sp. nov. Left figure, Type, No. 1035. Right figure, Paratype, No. 1034. From Siracha, Chon Buri, Thailand.

Table of data on type and paratypes of *P. angusticaudatus*

NUMBER	1036	1037	1035	1033	1034
Sex.....	♀	♂	♂	♀	♀
Length to vent.....	57	54	54	51	51
Tail length.....	47.5*	43*	61.2	53	53
Total length.....	104.5	97	115.2	104	104
Snout to arm.....	21	20	19	20	18.5
Axilla to groin.....	27	26	26	26	26
Width of head.....	11.8	11.5	10.4	10.1	10
Length of head.....	15	14.2	14	13	13
Arm.....	15	15	14.8	15	14.3
Leg.....	18.3	18	19	17.5	18.2
Pores.....	0	15-16	18-19	0	0

* Regenerated.

all scales peppered with fine pigment dots; subcaudal area darker, growing nearly blackish towards tip.

Distribution: Known only from Siracha, the type locality, in Chon Buri province.

Remarks: The specimens were taken in an old bamboo-nipa house that was being torn down. Numerous *Hemidactylus frenatus* were taken at the same place.

The regenerated tail is slightly denticulated, more flattened ventrally the subcaudals are wider, than in *mutilatus* and the dorsal caudal scales are not in straight transverse rows.

Two other species of *Peropus* are known in Chon Buri province: *P. laceratus* and *P. mutilatus*.

Peropus fehlmanni Taylor

Peropus fehlmanni Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 221-224, fig. 5 (type-locality, 4 Km NW Kanchanaburi Kanchanaburi province, western Thailand).

Diagnosis: Scales on dorsal part of head and body not distinctly conical; scales on snout subimbricate, double size of those on occiput and interorbital region; small distinct webs between digits on hands and feet; subcaudal scales at base of tail somewhat enlarged, followed by a single row of greatly enlarged subcaudals; largest body scales in preanal area; femoropreanal pores 22 forming an arched series extending onto femur for nearly half its length; scales on dorsal surface of slender tail somewhat irregular not forming distinct transverse rows; segments of tail not or scarcely indicated; seventh or eighth supralabial, and seventh infralabial below pupil of eye; third (outer) pair of chinshields separated from infralabials; ventrolateral fold not indicated.

Description of type: Rostral twice as wide as high, with a slight median depression on upper border and with an entrant suture whose length is slightly less than half height of scale; nostril surrounded by rostral, first supralabial, a supranasal, and two clearly differentiated postnasals; a slight frontal depression; supranasals separated by two small scales one behind the other; about 44 scales across snout between fifth supralabials; eight supralabials, last two small, with a row of about ten small body scales to mouth-angle;



FIG. 21.—*Peropus fehlmanni* Taylor. Type. From Taylor, Univ. Kansas Sci. Bull., vol. 43, No. 7, 1962, fig. 5.

seven infralabials, likewise followed by small scales to mouth-angle; mental with labial border equal to that of rostral, shaped like a quadrant; length of snout (4.2 mm.) greater than diameter of orbit (3.5 mm.); ear rather large (.7 to 1.0 mm. in diameter); median pair of chinshields pointed (angular) anteriorly, the width across upper half much greater than width posteriorly; second pair of chinshields much smaller than first, separated by first pair; third pair separated by preceding pairs and separated from infralabials by a scale; lower edges of chinshields forming a curve.

Arm with a very slight web in front of elbow joint; a distinct but small web between fingers; digits widened, each bearing six or seven paired lamellae preceded by a single lamella on under surface of widened part. Toes, similarly widened, one-fourth webbed. On all digits except inner, two distal phalanges rise vertically from near middle of upper surface of widened part, all clawed; inner digits lack two distal phalanges, but a small claw present at anterior edge of widened portion.

Scales on snout irregularly shaped, distinctly not conical, in places subimbricate. Scales on sides and latter half of back juxtaposed, flat, and much larger than scales on shoulders, neck, or occiput; venter covered with somewhat larger imbricating scales in about 42 rows; those low on sides and those on sides of venter not or scarcely differentiated from each other; seemingly there are no ventrolateral folds. An angular series of small rounded femoropreanal pores, eleven on each side extending halfway on femora.

Scales on dorsal and lateral surface of tail irregular, suggesting the possibility that the entire tail has been regenerated; tail narrow with a slight fringe along edges and tapering rapidly to a fine point; subcaudal scales widened, appearing to be normal and not reproduced.

Color: Above light-brown with black flecks scattered on head, body, limbs, and tail; ventral surface yellowish white, but all scales with small pigment dots; underside of tail more heavily pigmented with brown; the pigment on pore-scales tend to make an indefinite brownish circle on scale, but is not especially conspicuous.

Measurements in mm.: Snout to vent, 37; tail, 33; total length, 70; width of head, 8.2; length of head, 11.8; snout to arm-insertion, 15; axilla to groin, 16; arm, 10.5; leg, 13.2.

Variation: Not known.

Distribution: Known only from the type locality and Ronpibon, Nakhon Si Thammarat.

Remarks: The specimen was taken at night along the edges of a small rain-pool close to the road. It was moving about on the ground when discovered.

The second specimen in the collection, No. 35526 ♀, is from near Tonka Harbor Tin Mine, Ronpibon, Nakhon Si Thammarat. It has a snout-to-vent length of 40 mm. There is a rather sharply defined canthal line of cream dots bordered below by a darker line passing through the eye and terminating on the side of the neck. Two dark-brown marks extend back from nostrils to the frontal region; the back is brownish with small darker brown spots, some arranged transversely and at least two indefinite longitudinal rows of white dots or flecks. The ventral surface has a dense powdering of cinnamon-brown. The tail has been lost.

Peropus mutilatus (Wiegmann)

FIG. 22

Hemidactylus (Peropus) mutilatus Wiegmann, Nova Acta Acad. Caes. Leopoldino-Carolinae . . ., vol. 17, 1835 (type-locality, Manila, P. I.).

Hemidactylus mutilatus: Duméril and Bibron, *Erpétologie générale* . . ., vol. 3, 1836, pp. 354-355.

Peropus mutilatus: Fitzinger, *Systema Reptilium*, 1843, p. 103.

Dactyloperus insulensis: Girard, U. S. Exploring Expedition . . . Herpetology, 1858, pp. 277, 280 (type-locality, "Sandwich Islands"-Hawaiian Islands).

Hemidactylus (Peripia) mutilatus: Peters, Monatsb. Akad. Wiss. Berlin, 1867, p. 14.

Gehyra mutilata: Boulenger, Catalogue of the lizards in the British Museum (Natural History), 2nd Ed., vol. 1, 1885, pp. 148-149; The fauna of British India . . . Reptilia and Batrachia, 1890, pp. 96-97, fig. 28 (foot); Flower, Proc. Zool. Soc. London, Dec. 1, 1896, pp. 866-867; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 47; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, Dec. 1916, p. 152 ("Bangnara, Patani"); *ibid.*, vol. 2, June 1916, p. 52.

Peropus mutilatus: Stejneger, Proc. U. S. Nat. Mus., vol. 21, 1899, pp. 796-798, fig. 5 (chin); Bull. U. S. Nat. Mus., no. 58, 1907, pp. 180-182, figs. 171-173; Barbour, Mem. Mus. Comp. Zool. Harvard Col., vol. 44, 1912, 81; Taylor, Philippine Journ. Sci., section D, vol. 12, 1917, pp. 368-369; Dept. Agri. Nat. Res. Bureau of Sci., publ. No. 17, Dec. 12, 1922, pp. 62-65, fig. 6; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, p. 1082 (Loei, Rat Buri, and Nakhon Ratchasima, provinces).

Hemidactylus peronii Duméril and Bibron, *Erpétologie Générale* . . ., vol. 3, 1836, p. 352, pl. 30, fig. 1 (type-locality, l'Ile-de-France = Mauritius).

Peripia peronii: Stoliczka, Journ. Asiat. Soc. Bengal, 1870, p. 163; Tirant, Notes sur les reptiles et les batraciens de la Cochinchine et du Cambodge, 1885, pp. 86, 103.

Dactyloperus insulensis Girard, Proc. Acad. Nat. Sci. Philadelphia, 1857, p. 197 (extra p. 5) (type-locality, Hawaiian Islands).

Hemidactylus platyurus Bleeker, Naturrk. Tydschr. Nederland Ind., vol. 16, 1858, p. 31 (type-locality, Java, Sumatra, Nias, and Banka).

- Gecko pardus* Tytler, Journ. Asiat. Soc. Bengal, vol. 33, pt. 2, 1864, p. 47. (Type-locality ?.)
- Peropus packardii* Cope, Proc. Acad. Nat. Sci. Philadelphia, 1868, p. 319 (type-locality, Penang, Malaya).
- Hemidactylus navarri* Dugès, La Naturaliza, vol. 6, 1883, pp. 309-312, pl. 7 (type-locality, San Blas, Nayarit, Mexico).
- Gehyra bechei* Annandale, Rec. Ind. Mus., vol. 9, 1913, p. 307 (type-locality, Sarawak, Borneo).

Diagnosis: Scales following the widened divided lamellae on underside of digits, small in two or more rows; digits with very small webs between fingers, larger ones between toes; two or three pairs of chinshields; a long continuous series of from 25 to 41 lunate femoropreanal pores, angular mesially; rather large supranasals in contact with each other mesially. Tail depressed, usually flat on undersurface, laterally more or less denticulate. Skin fragile.

Description of species (from No. 76): Rostral (2.7 mm.) wider than high (1.5 mm.); somewhat flattened and depressed above with an entrant suture from above; a pair of enlarged supranasals in contact mesially; nostril surrounded by rostral, first supralabial, supranasal and two postnasals; a small frontal depression, area in front of orbits swollen; about 44 scales across snout between sutures of fourth and fifth supralabials; eight or nine supralabials, last two very small followed by eight to ten granules to mouth angle; eye moderately large its diameter (3.6 mm.) much less than length of snout (5.3 mm.); ear-opening with a diameter of .72 millimeters; infralabials seven, last small, followed by a row of granular scales to angle of mouth; mental with a labial border distinctly less than that of rostral; median pair of chinshields angular anteriorly, scales wider anteriorly than posteriorly; second pair of chinshields separated by first pair; third pair broken up into small scales, scarcely distinguishable as chinshields.

Arms short, digits dilated proximally with a series of lamella below, first single, next six paired, followed behind by two or three rows of small scales; two distal phalanges compressed, clawed, arising from middle of widened area except on inner finger which has a claw but no distal phalanges; legs short, adpressed limbs overlapping length of longest toe; a small web-remnant between digits; seven paired lamellae under longest toes, the scales in several rows under proximal part of toes. Tail broadened, nearly flat on ventral surface, the median scale series widened; tail segmented, the segments indicated by slightly larger denticulations.

Scales on snout somewhat irregular larger than those on occiput, but smaller than those on sides of body; scales not or scarcely im-



FIG. 22.—*Peropus mutilatus* (Wiegmann). EHT-HMS No. 76 "Thailand." Actual total length, 120 mm.

bricate the scales usually somewhat elevated frequently touching adjoining scales at only one or two points; a vague ventrolateral fold; scales behind chinshields on throat small, imbricate; scales on venter in about 38 rows, oval, rather than cycloid, imbricating, distinctly larger than dorsal scales for the most part. Scales in region below femora in regular curving transverse series; a series of transversely elongated femoropreanal pores, 13-18 (the irregularity partly due to a small injury), forming a median angle, and curving on each side. This series followed by one complete row of scales equally as large as the pore-scales. Tail segmented, basal segments with from ten to eleven nearly straight rows of small imbricating scales; median subcaudals much enlarged and widened, two to each segment; distal part of tail regenerated. No distinctive spines at base of tail.

Color: Dorsal surface brownish lavender nearly uniform with two median rows of dim rounded light spots; underside of head, venter and subcaudal region nearly yellowish white with a microscopic peppering of dark pigment; side of head lighter than dorsum.

Measurements in mm.: Length, snout to vent, 58; tail, 61; snout to arm-insertion, 19.5; axilla to groin, 26; width of head, 12.5; length of head, 15; width of tail near base, 10.8; arm, 16; leg, 19.

Variation: The femoropreanal pore-series varies ordinarily from 17-22 on each side and only rarely are they separated mesially. The thickness of the tail varies somewhat with age, the older specimens usually having a plumper tail.

Distribution: This species is very widely spread in Thailand, probably occurring in all provinces in suitable localities. It is equally common in houses in towns, villages and cities, as it is in the forest.

Outside of Thailand the species is in India, Ceylon, Burma, southern China, Indo-China, Malaya, the Indo-Australian Archipelago to the Philippines and Oceania; Mexico.

It is most likely that man has played an important role in distributing this species, either by accidentally transporting the animal or its eggs in baggage; or by specimens living on boats, leaving their home later to disembark in foreign ports.

Hemiphyllodactylus Bleeker

Hemiphyllodactylus Bleeker, Nat. Tijdschr. Ned.-Indie, vol. 20, 1860, p. 327 (type of genus *Hemiphyllodactylus typus*); Stejneger, Proc. U. S. Nat. Mus., vol. 21, 1899, p. 799; Brongersma, Zool. Meded., Leiden, vol. 15, 1932, pp. 211-213.

Spathodactylus Günther, Proc. Zool. Soc. London, 1872, p. 594 (type of genus *Spathodactylus mutilatus*).

Spathoscalabotes Boulenger, Catalogue of the lizards in the British Museum (Natural History), 2nd Ed., vol. 1, 1885, p. 157 (substitute name for *Spathodactylus* (non-Pictet) Günther).

Lepidodactylus (part.) Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 162.

Diagnosis: Four outer digits clawed, well developed, inner digit vestigial, not webbed, with or without claw, cylindrical at the base; digits bearing widened lamellae, at least distal ones divided mesially by a groove; last joints of digits short, arising from within widened part of digit (absent on inner digit). Dorsal scales small, granular, lacking enlarged tubercles; ventral scales cycloid, likewise small; preanal and femoral pores present; pupil vertical.

This genus of diminutive geckoes has suffered from synonymizing and a revision of the group will undoubtedly show that certain synonymized forms well merit specific designation. Malcolm Smith states the matter as follows: "In a form so widely distributed it is only to be expected that small morphological differences such as the number of labials, the size of the postmental shields and of the digital expansions and the number of preanal and femoral pores should be found." Often "small morphological differences" seen in a diminutive gecko are judged insignificant, but the same seen in a gecko of considerably greater size, would most certainly be regarded as significant.

Two species are recognized in this paper; one that has been called *Hemiphyllodactylus typus*; the other a species recently acquired from Phu Kading by Mr. Kumpol Isarankuara, Curator of the Zoological Collection of Chulalongkorn University. This I am referring to *H. yunnanensis*.

The two forms may be distinguished by the following key:

KEY TO THAI SPECIES OF HEMIPHYLLODACTYLUS

- Hind limb not reaching to more than half way between the axilla and groin; no distinct postmentals; males with preanal and femoral pores, *typus*
 Hind limb reaching more than half way between axilla and groin; postmentals distinct, males with preanofemoral pores in a single series *yunnanensis*

Hemiphyllodactylus typus Bleeker

FIG. 23

Hemiphyllodactylus typus Bleeker, Nat. Tijds. Nederl.—Ind., vol. 20, 1860, p. 327 (type-locality, Gunong Paring, Java); De Rooij, The Reptiles of the Indo-Australian Archipelago, vol. 1, Lacertilia, Chelonia, Emydosauria 1915, pp. 46-47, figs. 29, 30; Boulenger, Ann. Mag. Nat. Hist., ser. 5, vol. 20, 1887, p. 152; Brongersma, Zool. Med. Leiden, vol. 15, 1932, pp. 211-217 (monographic treatment, with bibliography); Deraniyagala, Ceylon Journ. Sci., sec. B, vol. 16, 1932, p. 308; M. Smith, Rec. Ind. Mus., vol. 35, 1933, p. 16.

Lepidodactylus ceylonensis Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885; p. 164, pl. 13, fig. 3 (type-locality, Gampola, Ceylon); The fauna of British India; Reptilia and Batrachia, 1890, p. 98; Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 316; Annandale, Journ. and Proc. Asiat. Soc. Bengal, n. ser., vol. 1, 1915, p. 84; Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, 1915, p. 239.

Spathodactylus mutilatus Günther, Proc. Zool. Soc. London, 1872, p. 594 (type-locality, Agam, Sumatra).

Spathoscalabotes mutilatus: Boulenger, Catalogue of the lizards in the British Mus., vol. 1, 1885, p. 157, pl. 13, fig. 1.

Diagnosis: Transverse lamellae under dilated digits divided mesially; digits either with rudiment of web or entirely free; compressed distal part of digits short, compressed, rising from extremity of dilated part; no claw on inner digit which varies in size; no enlarged tubercles among granular scales on body; ventral scales imbricate, flat. Males with preanal, or preanal and femoral pores.

Description of species (from M 32, EHT-HMS coll. Fraser's Hill, Malaya): Head length (13 mm.) greater than width (9 mm.); rostral more than twice as wide as high (2.3×1.1 mm.), bordered by first labial, nostril, supranasal and three small postrostrals; a slight notch above, but no entering suture; nostril surrounded by rostral, first labial, supranasal, and two postnasals; supranasals separated from each other by three rows of scales; 23 scales across snout between suture of first and second supralabials, 42 between fourth labials; supralabials 10-10, first large; seventh directly below pupil of eye; scales on snout and above eyelids larger than those on occiput; scales on shoulders and front part of dorsum smaller than on sides and rump; scales tubercular nonimbricating. Mental triangular, its border on mouth much smaller than rostral border; infralabials, 10-11; posterior labials small; a pair of small median chinshields touch mental; two rows of smaller scales behind chinshields; scales on chin and throat tubercular; scales on breast and venter larger, subcircular, imbricating, gradually merging into small granular scales on side; preanal and femoral pores continuous, angular mesially; area in front of preanal pores swollen (glandular?); scales behind pores very small except in preanal region where there are six or seven arched rows of larger scales; two strong hemipenial swellings each with three large bluntly pointed tubercles near edge of vent; when arm and leg are adpressed the fingers overlap; fingers with widened lamellae beneath, distal ones divided mesially, proximal ones single; four outer toes with distal phalanges compressed, arising from near edge of widened part, each with a claw.

Lamellae: 1st finger, five or six lamellae, none divided, claw absent; 2nd, eight lamellae, two outer divided with one distal



FIG. 23. — *Hemiphyllodactylus typus* Bleeker. EHT-HMS No. 32, Fraser's Hill, Malaya. Actual length, 86 mm.

median undivided; 3rd, ten lamellae, four divided distally with median distal single; 4th, eight lamellae, three outer divided and outermost single. On toes inner has five lamellae, the penultimate divided and with claw; on outer toes, two or three divided lamellae, terminal one small, single, a few proximal ones usually broken into three smaller scales.

A distinct basal web between fingers and toes. Scales on tail forming rather regular transverse rows on dorsal and lateral surfaces; scales on ventral surface larger, three median rows larger than others. The segments are not or very indistinctly marked.

Color: Above gray with a very fine powdering of cinnamon-brown; head rather more yellowish-brown; a dim dorsolateral row of rounded whitish spots from eye to groin. Venter yellowish white.

Measurements in mm.: Snout to vent, 46; tail, 40; width of head, 9; length of head, 13; snout to arm, 17; axilla to groin, 22; arm, 13; leg, 14.

Hemiphyllodactylus yunnanensis (Boulenger)

FIG. 24

Gehyra yunnanensis Boulenger, Ann. Mag. Nat. Hist., ser. 7, vol. 12, 1903, p. 429 (type-locality, Yunnan-Fu).

Cainodactylus yunnanensis: Barbour, Occ. Papers Boston Soc. Nat. Hist., vol. 5, 1924, p. 134, fig. (foot); Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 479.

Hemiphyllodactylus yunnanensis: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. II, Sauria, London, Feb. 7, 1930 (Yunnan, N. Laos, Upper Burma).

Diagnosis: A pair of somewhat enlarged postmentals; nine supralabials, ten infralabials; rostral nearly rectangular, with an entrant notch in its upper edge; preanofemoral pores, 12-12 (11-12), transversely widened; subcaudals not strongly widened.

Description of species (from C. U. No. 2676 Phu Kading, Loei province, Thailand): Rostral subrectangular with a small median notch on upper edge; a small pair of supranasals, separated by three granular scales, touching rostral; nostril bordered by rostral, first supralabial, internasal, and two small postnasals; scales on snout and in frontal area larger than those on occiput; occipital granules less than half size of those on frontal area; scales on dorsum larger than occipitals but smaller than scales on snout, cycloid, juxtaposed, becoming somewhat imbricate laterally; ventral scales cycloid, imbricating, the larger more median series double size of dorsal scales; nine supralabials, first largest, last two very small; ten infralabials,

first largest, last three small; pupil vertical; ear small situated below lateral dark neck-stripe, its diameter about one fourth of that of eye; four lamellae under widened part of fourth toe, at least three divided, followed by five or six single oblique scales or lamellae; first finger small with a minute claw, but no elevated terminal joint;

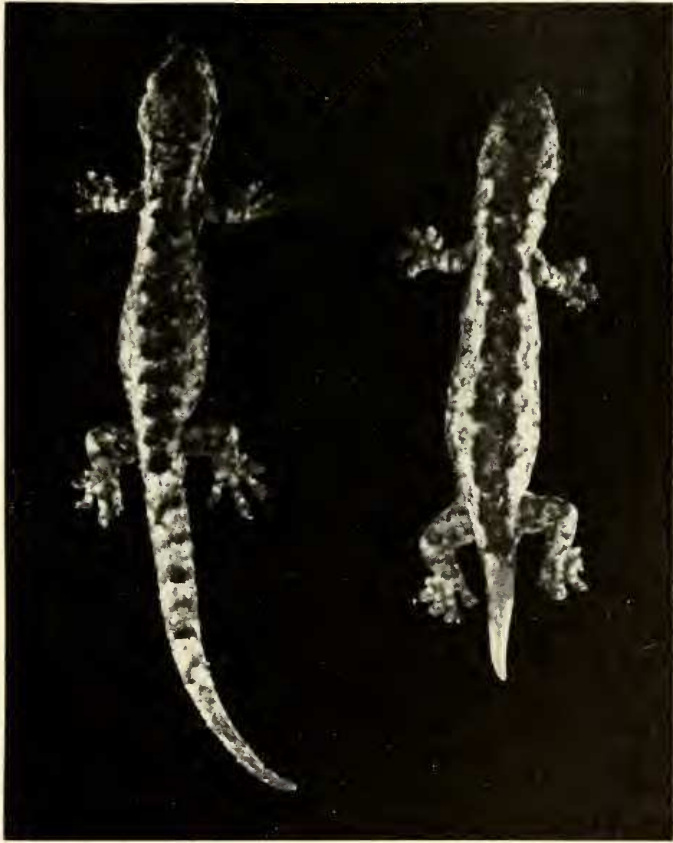


FIG. 24.—*Hemiphyllodactylus yunnanensis* (Boulenger). Left figure, No. 2677, Phu Kading, Loei province, 4800 ft. +. Actual total length, 64 mm. Right figure, No. 2677a, same locality. Actual length, 48 mm.

slight fringe on back of thigh; preanal and femoral pores in a continuous series of twelve (eleven) transversely widened pores, angular medially and extending nearly to knee; a strong tubercle on each side of basal subcaudal (hemipenial) swelling. Scales on dorsum smaller than those on dorsal caudal region; latter scales arranged in straight transverse rows; segments not distinctly marked; lateral

caudal scales considerably larger than dorsal caudals, but smaller than the somewhat irregular subcaudal scales which do not form a much widened median series.

Color: Above two lateral gray stripes with indefinite edges beginning on snout, becoming wider on body; a median darker brown irregular stripe with dark transverse marks on each side of this; (about nine or ten on body); arms and legs mottled brown and black; tail banded black and grayish brown; two indistinct cream spots above on base of tail; top of head variegated brown with some black; a more or less distinct series of cream spots on sides of the brown stripe on middle of back. A dark stripe from tip of snout through eye to above arm with cream-dots on black coloring on side of neck; lower sides flecked or mottled dimly in black or gray-black; underside light cream, finely pigmented; tail on male orange below, the dark bands widening on ventral surface.

Measurements in mm.: Total length, 64; tail (tip regenerated), 26.5; axilla to groin, 18; tip of snout to arm-insertion, 12.8; arm, 7.2; leg, 10; width of head, 6.6; length of head, 9.

Variation: Supralabials vary from 10 to 12; infralabials vary from 9 to 11. There may be one or two pairs of postmentals, the inner ones always the largest. The preanofemoral scales are in a continuous angular series varying from 12 to 22 in number (*vide* M. Smith). The maximum known snout-to-vent length is 42 mm., the total length 78 mm.

This species is very different from *Hemiphyllodactylus larutensis*, its closest geographical relative. A presumed hiatus in distribution of more than 600 miles occurs between the ranges of the two species.

Distribution: This is the first and only record of this species in Thailand. Three specimens were obtained on Phu Kading, Loei province by Nai Kumpol Isarankura of Chulalongkorn University, Curator of University collections.

I failed to find this species while collecting in this locality.

The species is known also in upper Burma, northern Laos, and Yunnan, China.

Genus GEKKO Laurenti

Gekko Laurenti, Specimen medicum, exhibens synopsis reptilium . . . 1768, p. 43 (type of genus, *Gekko verticillatus* = *Gekko gecko* Linnaeus).

Diagnosis: Digits widened, bearing undivided transverse lamellae, with or without webbing; claws present on four outer digits of hand and foot; terminal joint lying above widened portion and

attached to it; inner digit well developed, lacking claw and not extending beyond terminal edge of widened lamellae. Body with minute subequal scales or these with irregular rows of enlarged tubercles. Preanal, or preanal and femoral pores present.

The large *Gekko gekko* has become a very domestic animal and many houses in the city of Bangkok have their quota of individuals. Their presence is made known by their loud call repeated several times. They feed on insects and often consume individuals of the smaller species of domestic geckoes.

Two eggs are laid, usually in a fairly dark place. These are plastered against a surface, the eggs having a flattened biscuitlike shape. Several individuals may lay their eggs close together.

KEY TO SPECIES OF GEKKO IN THAILAND

1. Rostral forming part of border of nostril 2
 Rostral excluded from nostril 3
2. Nine or ten preanal pores; no femoral pores. Gray (yellow in life) with a median and two longitudinal rows of small circular whitish spots alternating with small blackish spots which may be absent *petricolus*
 Sixteen to twenty femoropreanal pores on each side; light brown to fawn, usually with median series of paired blackish spots, *monarchus*
3. Eight to twelve preanal pores on each side forming a continuous series angular mesially; five or six transverse scalarrows in each caudal segment; three to five small scales between dorsal tubercles; bluish gray above, profusely spotted with orange-red and grayish white, *gecko gekko*
 Five to eight preanal pores on each side; ten to twelve transverse scalarrows on each basal caudal segment; five to eight small scales between dorsal tubercles; gray or bluish gray above with or without indefinite darker spots *smithi*

Gekko petricolus Taylor

FIGS. 25, 26

Gekko petricolus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 227-229, fig. 7 (type-locality, Forestry Station, Sanoi River, Ubon province, Thailand).

Diagnosis: None or only merest remnant of a web between digits; inner digits well developed, lacking claws, subdigital lamellae undivided; body covered with fine subequal granules, intermixed with somewhat enlarged tubercles forming irregular rows separated by from two to five granules; postnasal and frontal areas depressed; rostral entering nostril; venter with about 30 rows of larger cycloid scales, somewhat imbricate; subcaudals widened except at base of tail and at tip; each proximal caudal segment with four enlarged

tubercles. Tail slender, depressed; nine or ten preanal pores, no femoral pores. Adults yellow in life with a lavender-gray head; numerous rounded whitish spots evident.

Description of species: Male type. Rostral a little less than twice as wide as high, its upper edge somewhat concave with a Y-shaped median groove; a pair of large supranasals narrowly in contact mesially; nostril surrounded by rostral, supranasal, two postnasals and first supralabial; supralabials twelve, followed by a number of small scales running back to mouth angle; mental with a labial border equal to that of rostral; ten or eleven infralabials, followed by small scales bordering mouth to its posterior angle; mental followed by two somewhat elongate chinshields; these flanked on each side by three (or four) somewhat enlarged chinshields in contact with infralabials; this enlarged series continues back on each side for several scales, but these scales are separated from infralabials by one or more series of small scales; scales on chin and throat small, cycloid, imbricating, their posterior edges serrate or tuberculate when seen under a lens; an occipital depression somewhat separated by a ridge from fronto-interorbital depression; area behind nostril somewhat depressed; about 47 scales across snout between seventh labials; eye large, diameter of orbit (7 mm.), much shorter than snout (10.5 mm.); "eyelid" completely surrounding eye, with a short series of spinous scales on its posterior border; ear-opening moderate, its greatest (diagonal) diameter about three millimeters; largest scales are on snout on an area anterior to eye, and on supra-orbital region; interorbital and occipital areas with smallest scales; about 38 scales across head between median edges of upper eyelids. Dorsal scales small, rather uniform, granular, with about 16 irregular rows of larger rounded moundlike tubercles; tail indistinctly segmented, each segment with ten to twelve transverse rows of small scales and with two or more enlarged flattened scales near posterior part of segment; scales of basal subcaudal region not greatly enlarged; transversely widened median plates under tail for most of its length, extending to near tip of tail, where widened scales are replaced by rows of small scales. Tail flattened, narrowed, tapering to a fine point.

Arms and legs well developed; digits with scarcely a trace of webs; divided lamellae under digits except at base; elevated terminal joint with claw, extending beyond widened part of digit; claw absent on inner finger, which otherwise is well developed. About 20 lamellae under fourth finger and toe, basal ones broken or divided into small scales; hind leg reaches beyond elbow; a



FIG. 25.—*Gekko petricolus* Taylor. From Taylor, Univ. Kansas Sci. Bull., vol. 43, No. 7, 1962, fig. 7.

somewhat curved series of nine preanal pores, followed by a preanal area covered by seven rows of widened scales; openings of postanal sacs evident just preceding hemipenial swellings.

Color in life: On back, sides of body, and tail, yellow with small rather symmetrical yellowish-white marks; some darker flecking visible; head lavender-gray; underside of body and tail yellowish to dirty white. In preservative dull gray, white spots rather dimly visible.

Measurements of type in mm.: Snout to vent, 98; tail, 114; axilla to groin, 45; head width, 20; head length, 25.

Variation: The type series, all taken in the same locality, was constant in color save that younger specimens failed to show the yellow coloration but were gray and white in color. The femoral pores were either nine or ten in number, the exudate from them being glass-clear and projecting strongly from the pores. Variation in number of scales across snout between seventh labials is from 43 to 47; across the middle part of venter between the ventrolateral folds, the number of scales varies between 27 and 32.

Sometimes the supranasals are separated from each other by a single scale instead of two scales. The rostral suture in one specimen is X-shaped.

The subcaudal scale-count from vent to tip of tail varies from about 104 to 110, the basal and terminal ones not enlarged.

The color of the adults varies but little. The yellow color disappears in the fixative within 36 hours. One young specimen differs as follows: above generally gray; head somewhat darker with numerous very small blue-white flecks or spots with slightly larger ones on occiput; a few blacker flecks also present; dorsum lighter gray than head with a row of seven small dashlike black marks along the middle line, these marks alternating with rounded bluish-white spots which continue onto tail; a similar dorsolateral and a lateral row of more indefinite dark spots also interspersed with rounded blue-white spots. Arms and legs gray with numerous whitish flecks and spots sometimes tending to form a reticulum; tail light with twelve broad dark-gray bands reaching to ventral surface; entire undersurface of head and body white or cream-white with some yellowish wash; under a lens some scattered fine pigment can be seen, the pigmentation a little heavier under tail. (Specimen figured.)



FIG. 26.—*Gekko petricolus* Taylor. Paratype, young. No. 34853 Forest Station, Sanoi River, Ubon province. Actual length, 136.

Distribution: Known only from the sandstone hills near the border of Thailand and Laos. It probably occurs also in the mountains between Cambodia and Thailand.

Remarks: The weathering of the sandstone exposed along the Laos border leaves boulders and table-rocks in profusion. The animals occupy horizontal crevices between the rocks, in which places they were almost invariably found upside down. Eggs are usually placed on ceilings. In certain small overhanging rocks, remnants of dozens of eggs could be seen on ceilings six or eight feet above the floor. One exception was a pair of eggs placed on a large boulder that offered no crevices. These were on a vertical side of the boulder a few inches from the earth, covered accidentally by a pile of windblown leaves.

The eggs are rather small in diameter (9-11 mm.) and about 8 mm. high. They are somewhat moundlike, the two cemented together and plastered against rock. It is practically impossible to remove them without breaking them.

A single young specimen, No. 34855, was taken at the type locality in 1958. It was found in a pile of discarded boards not far from a group of boulders. Two of the present series were taken in a shelter-house built over exposed boulders at the very edge of the Sanoi River.

At no time did I hear them call.

One pair of embryos taken from eggs, measured 45 mm. (22 mm. snout to vent, the tail, 23 mm.).

Gekko monarchus Schlegel, in Duméril and Bibron

FIG. 27

Platydictylus monarchus Schlegel, in Duméril and Bibron, *Erpétologie Générale* . . . , vol. 3, 1836, p. 335 (type-locality, Amboyna); Cantor, *Journ. Asiat. Soc. Bengal*, vol. 16, 1847, p. 625; Girard, *United States Exploring Expedition during the years 1838-42*, vol. 20, *Herp.* 1858, p. 292.

Platydictylus (Scelotretus) monarchus: Fitzinger, *Systema Reptilium*, 1843, p. 101.

Gekko monarchus: Gray, *Catalogue of the specimens of lizards in the collection of the British Museum*, 1845, p. 16; Günther, *Reptiles of British India*, 1864, p. 103; Theobald, *Descriptive catalogue of the reptiles of British India*, 1876, p. 72; Boulenger, *Catalogue of the lizards in the British Museum*, vol. 1, 1885, p. 187; The fauna of British India, . . . Reptilia and Batrachia, 1890, p. 103; Flower, *Proc. Zool. Soc. London*, 1899, p. 635; Boulenger, *Fasciculi Malayenses, Zoology*, vol. 1, 1903, p. 150; Boulenger, *The vertebrate fauna of the Malay Peninsula*, . . . Reptilia and Batrachia, 1912, pp. 51-52; M. Smith, *Journ. Nat. Hist. Soc. Siam*, vol. 2, Dec. 1916, p. 152. "Bangnara Patani" [= Narathiwat, Narathiwat]; *Bull. Raffles Mus.*, no. 3, Apr. 1930, p. 18.

Diagnosis: A medium-sized species reaching a snout-vent length of about 100 mm. Digits moderately dilated with a web-rudiment;

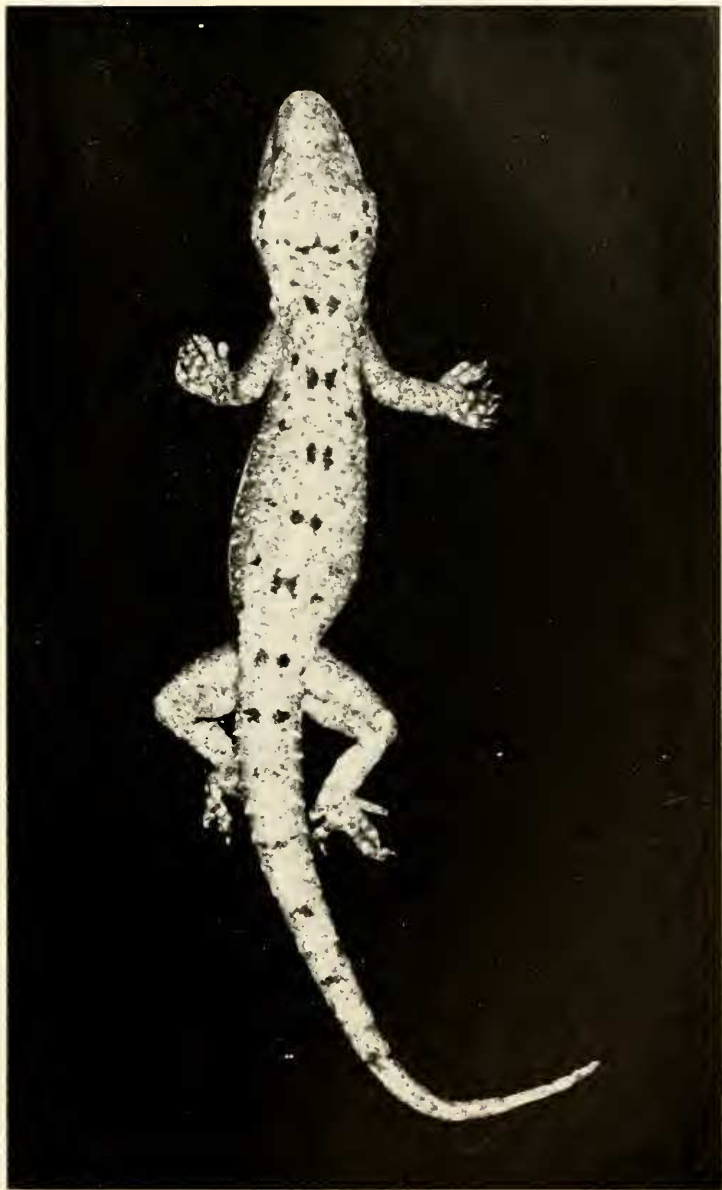


FIG. 27.—*Gekko monarchus* Schlegel, in Duméril and Bibron. EHT-HMS, No. 3355, Maxwell's Hill, Malaya. Total length, 139 mm.

rostral entering nostril; a large median pair of chinshields; back covered with small granules intermixed with larger granules; a long continuous series of preanal and femoral pores, 16-20 on each side. Light brown to fawn with small, usually irregularly paired black spots on head, body, and base of tail; distal parts of tail banded.

Description of species (from No. 30313 from Kuala Lumpur, Malaya): Rostral bordering nostril two thirds as high as wide, notched on median upper edge, with two short grooves or sutures in upper part of scale; nostril bordered by a supranasal, two postnasals, first labial and rostral; a somewhat enlarged scale in rostral notch, followed by two smaller scales, the three lying between supranasals; an occipital depression preceded by an interorbital depression; about 45 scales across snout between sixth supralabials; about 43 granular scales between supraciliary edges across interorbital region; eye rather large, diameter of orbit a little less than half length of snout; scales on snout much larger than those in interorbital region or occiput; eleven distinctly enlarged supralabials, ninth and tenth lying below pupil of eye; width of mental about two thirds of the width of rostral; 12 infralabials, the first largest with a posterior projection; a pair of elongate median chinshields with a smaller outer pair; eight scales lying behind chinshields in a row between third infralabials; ear-opening moderate; scales of dorsum and sides fine, granular, with 16 or 17 irregular rows of enlarged conical or pyramidal granules, smaller mesially and on lower part of sides; venter covered with cycloid imbricate scales between two somewhat indistinct ventrolateral folds, median scales larger than outer; a continuous series of femoropreanal pores, twenty on each side, bordering posterior edge of a glandular swelling on undersurface of thighs. Hemipenial swellings covered with somewhat enlarged scales; a series of about 104 widened subcaudal scales; occasional ones divided. Tail segmented, segments marked by transverse series of six enlarged tubercles, with a secondary transverse row also indicated on basal segments; digits moderately widened with a narrow web remnant on hand and foot; terminal phalanges of four outer digits somewhat compressed, bearing claws; inner digit lacking claw; about 20 lamellae under longest toe, basal ones segmented into three or four parts; postanal sacs present, openings evident behind vent.

Color in life: Above cream, with a brownish wash, becoming darker in preservative; cream to yellowish below; top of head with

two diagonal elongate spots bordering occiput, widened mesially; other indistinct spots or flecks of black on occipital and interorbital regions; back with nine or ten small irregular paired spots; some spots on base of tail, the distal portion banded in black and cream; many dorsal tubercles are cream. Lower surfaces whitish or cream-white.

Measurements in mm.: Snout to vent, 80; tail, 104; width of head, 17.2; length of head, 22; snout to arm, 28; axilla to groin, 37; arm, 23.5; leg, 35.

Variation: The number of supralabials and infralabials varies from 10 to 13; the number of femoral pores from 16 to 20 on each side. The apparent amount of pigment in the scale changes, individuals taken at night being lighter in color.

Distribution: The species enters Thailand in the extreme south. A specimen is known from Narathiwat,* Narathiwat. Elsewhere it is known in Malaya and the Indo-Australian Archipelago to the Philippines.

Remarks: The species is nocturnal and its call is heard most frequently at twilight. It is occasionally seen in human habitations that are close to forest. It is not a typically domestic form such as *Gekko gekko*, however, Boulenger (1912) states "Very common in houses in Singapore." I obtained many from a house on Maxwell's Hill in Perak, but none elsewhere in houses.

Gekko gekko (Linnaeus)

Lacerta gekko Linnaeus, Systema naturae, Ed. 10, 1758, p. 205 (Certain subspecies are recognized one of which occurs widely in Thailand).

Gekko gekko gekko (Linnaeus)

FIG. 28

Lacerta gekko: Linnaeus, Amoen. Akad., Tom. 1, no. 5, p. 133; Linnaeus, Systema naturae, Ed. 10, 1758, p. 205 (type-locality "habitat in Indiis"); Anderson, Bihang Sven. Vet-Akad., Band 26, Afd. 4, no. 1, 1900, pp. 13-14.

Gekko verticellatus Laurenti, Specimen medicum, exhibens synopsis reptilium emendatum . . . , 1768, p. 44 (Based on Seba, Thesaurus, vol. 1, pl. 108, figs. 2, 6 (type-locality, India); Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 183; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 102; Flower, Proc. Zool. Soc. London, 1899, p. 631; de Rooij, The reptiles of the Indo-Australian Archipelago, vol. 1, 1915, pp. 56-57, figs. 33a, 34, 35; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, pp. 52, 152 (Klong Wang Hip, Nakhon Si Thammarat)).

Gekko gekko: M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 111-112, fig. 32.

* The specimen was collected at "Bangnara, Patani" (now in the province of Narathiwat) by Mr. C. J. Aagaard.

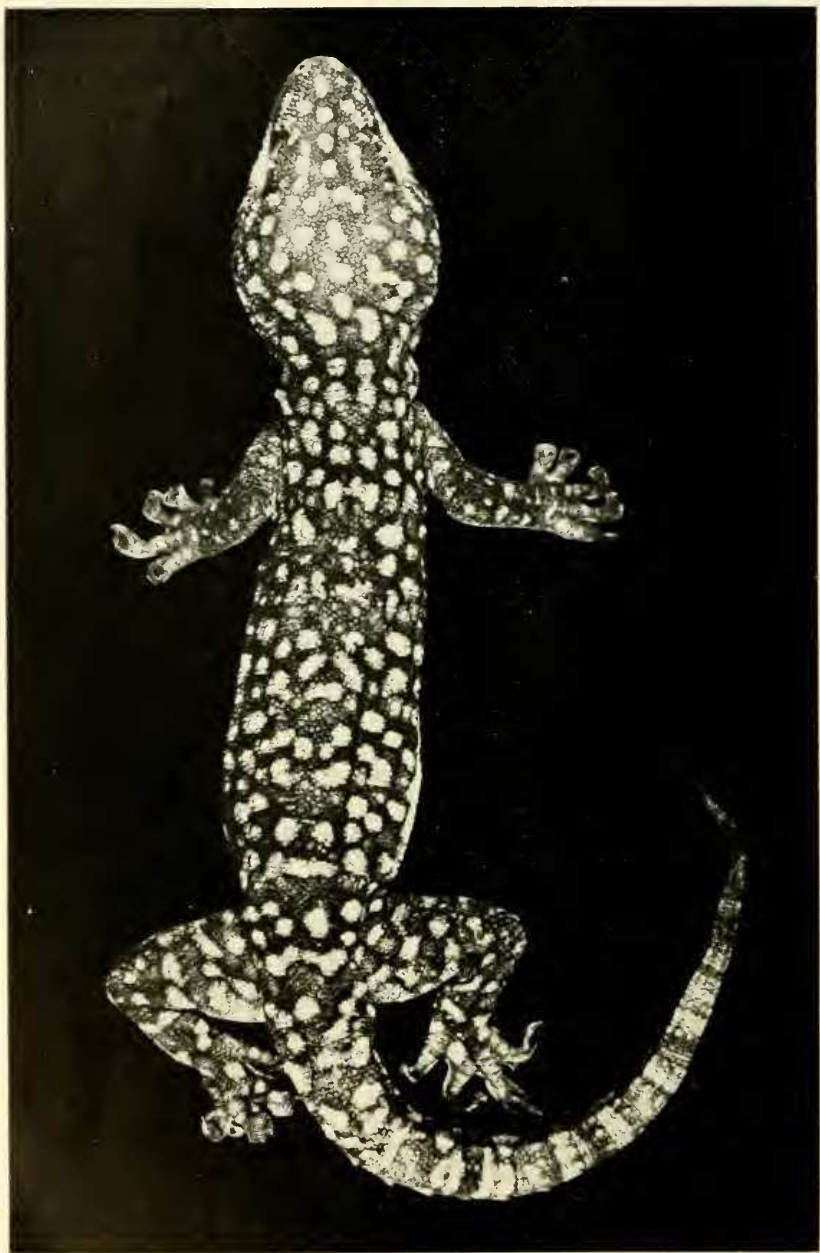


FIG. 28.—*Gekko gecko gecko* Linnaeus. No. 4028 Chiang Mai city. Total length, 292 mm. Tail partially regenerated.

Platydictylus guttatus Duméril and Bibron, *Erpétologie générale* . . . , vol. 3, 1836, pp. 328-331; Daudin, *Histoire naturelle des reptiles*, vol. 4, 1802, p. 122, pl. 49 (type-locality unknown).

Gekko indicus Girard, U. S. Exploring Expedition, herpetology, 1858, p. 290, pl. 16, figs. 9-16 (type-locality, Island, in Balabao Strait, China Sea).

Diagnosis: A large domestic and forest species reaching a length of about 350 mm. Head large covered with small polygonal scales; male with five to twelve preanal pores on each side forming a median wide angle; small scales above intermixed with series of larger tubercles. Gray to ultramarine above, with brick- or orange-red spots and numerous gray-white spots; digits entirely free with numerous undivided lamellae on undersurface.

Description of species (from No. 440, Khao Chong Forest Experiment Station, Trang): Large-headed species; rostral nearly twice as wide as high, subrectangular, notched above mesially and with a small entrant suture, bordered laterally by a supralabial and behind by two prenasals and a single internasal; nostril separated from rostral, surrounded by the prenasal, two supranasals, two postnasals and first labial; eighteen granular scales across snout between third supralabials; supralabials 13-14, followed to mouth-angles by undifferentiated scales; infralabials eleven; mental small, with a labial border much smaller than that of rostral; median pair of chinshields in contact throughout most of their length; on each side of these, three scales touching infralabials; scales in occiput and interorbital regions small, subequal, about 21 between median supraciliary edges; auricular opening vertically placed, tympanum deeply sunk; scales on swollen portion of lower jaws larger than those on median parts of chin and throat.

Dorsal scales on body, tail, and above limbs, small intermixed with conical tubercles forming 12-14 indefinite rows; on tail they are arranged in transverse whorls, one to each tail segment together with six to eight rows of smaller scales. A pair of ventrolateral folds separated by 24 rows of scales not or scarcely imbricate. Median subcaudal scales somewhat enlarged, paired; a somewhat angular series of ten imperforate preanal scales (represented by pores in males).

Digits with a slight basal web, each covered below with widened undivided lamellae, 20 under longest finger, and 22 under longest toe followed by three or four flat scales; distal phalanx and claw arising from widened terminal portion; inner finger and toe lacking claws and distal joint.

Color in life: Above ultramarine, head with numerous rusty-red

spots; back and sides with scattered rusty-orange spots, and an indefinite series of gray or very light ultramarine spots forming five or six transverse bands across back, the spots often confluent; tail dimly banded in dark and light ultramarine. Chin and venter with some indefinite orange flecks on a gray-white background; lamellae under digits blackish.

Measurements in mm.: Snout to vent, 134; tail (tip regenerated), 114; snout to arm, 47; axilla to groin, 69; head width, 30; head length, 41; arm, 43; leg, 52.

Variation: The variation in this species is not great, except that the number of preanal pores varies between 10 and 24. The color may be gray, or violet-gray. The markings in the young specimens are more distinct, the tail being banded with blue and white. The ventral spotting may be pinkish or rusty-red as well as orange.

The largest specimen I have seen measures 185 mm. snout to vent, the tail 179, totalling 364 mm.

Distribution: With the possible exception of high mountains the species is ubiquitous within Thailand. Outside the country the species is widespread from northeastern India, through southern China, Thailand, Indo-China, Malaya, and the Malayan Archipelago to the Philippines.

Remarks: The presence of this species is often made known by a series of loud sounds, variously interpreted as Tuk-ko—Tuk-ko, repeated several times, and usually preceded by a “cackle” and often terminating in a low gurgle sometimes sounding like a laugh. While the call is usually given at night or in the evening, it occasionally can be heard during daytime.

Many legends have grown up about this striking domestic species. The one that is repeated most frequently relates that the lizard holds his mouth open (a characteristic defense attitude) so that a snake (a friend) may eat of its liver which has grown so large that it pains the animal. The particular kind of snake involved varies from place to place. One should of course realize that such folklore is fiction and not scientific fact.

The biscuit-shaped eggs are plastered together and against a surface, usually in some dark place, and left to hatch. Each female lays only two hard-shelled eggs at a single laying. Frequently several females will deposit their eggs together in the same place.*

* In an ancient burial cave on Tablas Island, in the Philippines, whose “top” had very recent slipped off into the sea, I found that all the skulls in the exposed burial jars were filled with the egg-shells of this species. Many eggs were plastered on the shells of eggs already hatched.

Gekko smithi Gray

FIG. 29

Gekko smithi Gray, Zoological Miscellany, May, 1842, p. 57 (type-locality, "Prince of Wales Island" = Penang); Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, 1870, p. 161, and vol. 41, 1872, p. 92; Anderson, Proc. Zool. Soc. London, 1871, p. 159.

Platydictylus stentor Cantor, Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 624 (type-locality, Penang Island); 1847, p. 18 (separate of the above).

Gekko stentor: Günther, Reptiles of British India, 1864, p. 102, pl. 11, fig. A; Boulenger,* Catalogue of the lizards in the British Museum, vol. 1, 1885, pp. 184-185 (Penang, Andaman Is. Borneo, Sumatra); Fauna of British India; Reptilia and Batrachia, 1890, p. 103, (Burma, Malay Peninsula, Java); Fasciculi Malayenses, Zool., vol. 1, 1903, p. 150; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 51; M. Smith, Bull. Raffles Mus., Singapore, no. 3, Apr. 1930, p. 18 ("Patani," Thailand).

Gekko verreauxi Tytler, Journ. Asiat. Soc. Bengal, vol. 33, 1865, p. 546 (type-locality, Andaman Is.).

Gekko albofasciatus Günther, Ann. Mag. Nat. Hist., ser. 3, vol. 20, 1867, p. 50 (type-locality unknown).

Gekko smithi: M. Smith, Fauna of British India, including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 111-112.

Diagnosis: One of the largest geckoes, reaching a length of 340 millimeters. Throat with minute granules; preanal pores 11 to 16; each tail segment with 10-11 transverse rows of scales; usually two series of enlarged subcaudals. No reddish spots; rostral fails to border nostril.

Description of species (from EHT-HMS M. 225): Head large, snout length greater than distance between eye and ear-opening. Rostral low, nearly twice as wide as high with an upper entrant suture, bordered laterally by supralabials, posteriorly by a prenasal and a supranasal that lie largely in front of nostril separating rostral from the nostril border, and a small median internasal; nostril bordered by first supralabial, prenasal, supranasal, and three postnasals; nostril elongate, oval; supralabials, 14-16 last very small, followed on labial border by twelve or more small granules which are bordered above by four larger scales; infralabials, 11-11; mental with a smaller labial border than rostral; pair of moderately elongated median chinshields, each followed by a series of five or six chinshields or sublabials in contact with infralabials; auricular opening moderate (diameter, 4 mm.) separated from eye by a distance more than three times its diameter.

Scales on sides and front of snout rounded, juxtaposed, many with a tiny median elevation; smallest in the shallowly concave frontal

* Günther and Boulenger (1885) did not accept Gray's name, the latter stating that it was inadequately described—"no proper description." However by present definition of "proper description" this name must be used. Malcolm Smith reinstated the name in 1935 (*loc. cit.*). I follow him in this usage.



FIG. 29.—*Gekko smithi* Gray. EHT-HMS No. M.16 (2160) Kepong Forest Reserve, Selangor, Malaya. Actual snout-vent length, 161 mm.; total length, 309 mm.

and occipital areas; scales above eyelids nearly as large as those on snout; scales on dorsum small, juxtaposed, with 12 rows of large flat rounded tubercles (rarely conical), the rows somewhat irregular, growing gradually smaller as they approach the occipital concavity.

Scales on chin very small, juxtaposed, those on venter larger, cycloid, imbricating; a pair of ventrolateral skinfolds; scalerows between folds on venter about 24; near middle of venter two rows are fused to produce a row of widened scales that continues for a short distance. A transverse series of seven preanal pores, the scales not enlarged more than adjoining rows.

Tail segments strongly marked by transverse series of tubercles, eight on basal segments six on intermediate segments and four more distally, each segment also has about eight or nine rows of small scales; subcaudal scales paired, transversely widened (occasionally single scales). Total subcaudal pairs approximately 103. Tubercles present on forearm but more on upper arm; present also on dorsal part of thigh and tibia; fingers and toes with widened lamellae under proximal parts; near middle of widened portion of digit, distal phalanges arise at an angle and extend forward but attached to the widened part by a web as far as its anterior edge.

The terminal joint and claw absent on inner finger and toe; a small basal web or web remnant between middle digits. Twenty lamellae under longest digits of hand and foot; 15 to 17 under inner digits. Addressed legs reach elbow; two large tubercles on sides of tail-base (male).

Color: Above gray with eight transverse rows of white tubercles on body, first two tending to form curved series on back of occiput. Venter gray-white the tail gray below; above banded with light gray and dark gray.

Measurements in mm. (Nos. EHT-HMS M. 16 and M. 225, respectively): Snout to vent, 161, 172; tail, 148, 155; * snout to arm-insertion, 57, 62; axilla to groin, 76, 85; width of head, 31.5, 35.8; length of head, 40, 47; arm, 47, 54; leg, 68, 73.

Variation: The number of supralabials varies from 12 to 16, the infralabials from 10 to 12, the variation being chiefly in the small posterior scales of the series. In the younger specimens the dorsal tubercles appear somewhat conical. Preanal pores vary from 7 to 16; this may be, in part, geographical variation, however, in two specimens from Selangor, one has 7, the other 12 pores. There are

* Terminal 80 mm. reproduced. Both specimens from Selangor.

three prominent moundlike tubercles on each side of the base of the tail.

In No. M 16 the supranasal on each side is divided and a separate prenasal stands between the rostral and the nostril.

Distribution: In Thailand the species has been taken only in "Patani" = Narathiwat.

It is known also in Malaya, Burma, Sumatra, Borneo, and Java. The type-locality is Penang.

Remarks: The species is arboreal usually keeping to tall forest trees. I have seen individuals of the species on two occasions in Johore, Malaya and once in a tree near Bhetong, Yala Province, Thailand. All were at considerable elevation and all escaped.

Genus PTYCHOZON Fitzinger *

Ptychozoon Kuhl, Isis, 1822, p. 475 (*nomen nudum*); Fitzinger, Neue Klassifikation der Reptilien nach ihren natürlichen Verwandtschaften; Wien, 1826, p. 13 (type of the genus *Lacerta homalocephala* [= *P. kuhli* Stejneger]).

Diagnosis: Digits strongly webbed, dilated, the lamellae below transversely widened and not divided; terminal phalanges of outer four digits on hand and foot bearing claws but more or less attached to the widened part; terminal phalanges and claw absent from inner finger and toe; dorsal squamation consists of small scales or with small scales and enlarged tubercles; a skin-flap on sides of head, one on sides of body, while the skin expansion on tail is divided into numerous separate scallops, the terminal portion of which may be widened into a single enlarged flap. Pupil vertical; male with preanal and/or femoral pores.

Two species have been found in Thailand, a third occurs in Malaya at approximately the same latitude as the southern border of Thailand and it most probably occurs also in that country. The species may be differentiated by the following key:

KEY TO SPECIES OF PTYCHOZON

1. Male with preanal and femoral pores separated; no enlarged dorsal tubercles; tail tapering gradually to tip, scallops on tail smaller and directed somewhat backwards; no enlarged tubercles (not known in Thailand) *horsfieldi*
 2. Dorsal body scales intermixed with larger tubercles; preanal pores, 20-25; tail widened at tip into a flap, the scallops wider than in *horsfieldi* and placed at right angles to axis of tail *kuhli*
- Males with from 16-25 preanal pores; no enlarged tubercles intermixed with dorsal body scales; scallops narrow directed somewhat backwards; tail not forming a widened flap at tip *lionatum*

* Kuhl's use of this name seems to be *nomen nudum*. Fitzinger places *P. homalocephalum* as the single species in the genus hence it becomes the type of the genus by monotypy.

These species are nocturnal, hiding by day in dark crevices or inside the trunks of hollow trees, occasionally entering buildings constructed in forested areas.

One might suspect that *lionatum* and *kuhli* were geographical forms of the same species since the former occurs in northwestern Thailand where the latter is unknown. However, both species occur in the mountains only a few miles apart and at about 300 meters elevation in the southern part of the province of Nakhon Si Thammarat.

I have observed an individual *P. intermedium* jump from a point on a tree at an elevation of eight feet, land on the ground some ten feet from the tree, remain motionless, quickly becoming much darker in color and nearly invisible in dark surroundings. The lateral flaps on the body were expanded in flight.

Two eggs are placed under bark or on the boles of trees where the sun seemingly cannot reach them. The eggs are biscuit-shaped, usually plastered to the surface of smooth-barked trees and to each other. I obtained a double-headed embryo of *P. intermedium* on a tiny islet in the Sulu Archipelago from one of two such eggs found under dead bark.

Ptychozoon lionatum Annandale

FIG. 30

Ptychozoon homalocephalum Cantor (*part.*) Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 626; Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 316 (*part.*).

Ptychozoon homalocephalum var. *lionatum* Annandale, Ann. Mag. Nat. Hist., ser. 7, vol. 15, 1905, p. 30 (type-locality, Pegu, Burma).

Ptychozoon lionatum: M. Smith, The fauna of British India, . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 118-120.

Diagnosis: Head and body flattened, with a skin-flap on side of head below ear; a lateral skin-flap extending on side from axilla to groin; other skin-flaps on front of arm, upper anterior part of tibia, posterior part of thigh and posterior edge of tibia; digits strongly webbed; lamellae under distal part of digits transversely widened and undivided; inner digits lacking distal phalanges and claw; preanofemoral pores, 15-16, present in males; tail tapering to tip, the lateral dermal flap scalloped; no enlarged dorsal tubercles intermixed with body scales; small scales present on underside of lateral skin-flap.

Description of species (from No. 35538, Khao Chong Forest Station, Trang, May 22, 1958; taken at night on a pavilion near waterfall): Rostral 4.2 x 2.1 mm., subrectangular, bordering nostril, first supralabials, two supranasals, and an internasal nearly as large as

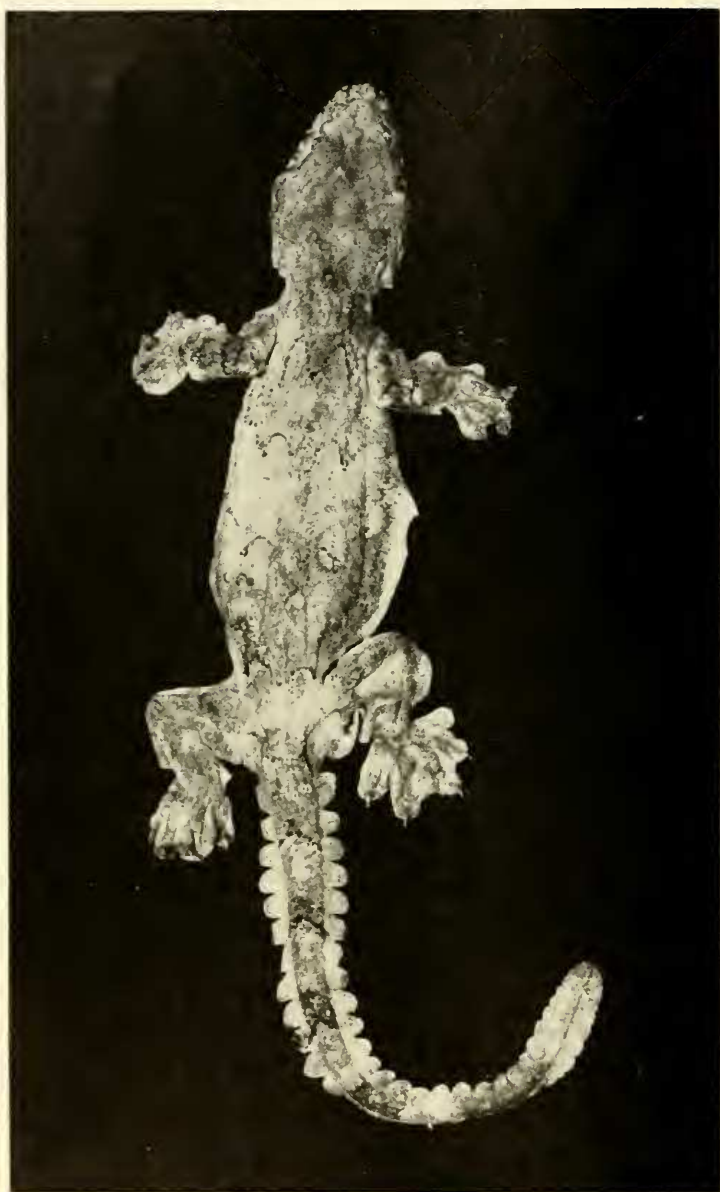


FIG. 30.—*Ptychozoon lionatum* Annandale. Khao Chong Forest Experimental Station. Trang province, Thailand. Actual total length, 161.5 mm.

anterior supranasal; a straight vertical median suture in upper part of rostral; rostral borders nostril above and in contact with two scales the upper one of which also borders nostril; a single large postnasal and first supralabial complete nostril border; about 32 scales across snout between sixth supralabials; supralabials, 13-14, posterior ones much reduced in size, and series followed by smaller scales to mouth-angle; infralabials, 11-11, followed by several small scales to mouth-angle; mental small, its labial border scarcely half that formed by rostral; a pair of median chinshields less than twice as long as wide, in contact for five sixths of their length; second pair of chinshields about half size of first pair, separated by first pair; three succeeding pairs separated by preceding chinshields becoming gradually smaller, fourth pair separated from each other also by about 17 granules; sublabial scales following somewhat enlarged; a patch of enlarged scales on lateral skin-flap below ear-opening; greatest width of flap 4.15 mm.; a slight depression behind nostril; a slight interorbital depression extended somewhat on frontal region; scales on snout larger than those in interocular, and occipital regions; scales on dorsum small, nearly uniform, somewhat rounded, pavementlike; no enlarged tubercles intermixed either on body, head, or limbs; lateral skin-flap with transverse series of five to eight enlarged scales and two to four smaller distal rows; underside of flap with small granules; other skin-flaps on limbs with patches of enlarged scales; venter with about 68 rows of cycloid, imbricated scales; seven or eight preanal rows of scales following a slightly angular row of twenty pore-scales, some with depressions (female); (male with as many pores); tail segmented, each segment bearing a free flap or united at base with succeeding flaps; distally flaps are united for most of their length; terminal ones being scarcely indented on their edges; scales above each segment forming seven to ten transverse rows; subcaudal scales enlarged, median pairs largest, usually four rows to a segment; approximately 28 segments, terminal ones of last four millimeters of length not clearly differentiated; digits with transverse lamellae, 17 or 18 under fourth finger and toe, distal ones widest and slightly angulate; webbing extends to widest point on distal part of digits; two distal joints of digit tend to form an angle with remainder of digit and fused with widened part below it; two last joints with claw, absent from inner digits; about 94 granules from chinshields to a line drawn between shoulders; approximately 94 scales from breast to vent; postanal slits present; upper and lower borders of vent, smooth, liplike.

Color and markings: Dull gray-lavender with four narrow transverse brown marks, which are sinuous or lobulated; head nearly uniform gray-lavender; supra- and infralabials nearly white with some sutures between scales edged with black; tail with several spots or bands, their posterior edges angulate, becoming elongated distally; chin, throat, and breast whitish, with very little scattered pigment; venter with denser pigmentation; subcaudal region with dark bands, posteriormost longest; distal part of body-flaps lighter in color than proximal parts.

Measurements in mm.: Total length, 161.5; snout to vent, 80.5; tail, 81; length to arm-insertion, 29; axilla to groin, 39; length of head, 24.6; width of head, 16.3; greatest width of body-flap, 7.1; arm, 24; leg, 32.

Remarks: This specimen was found about 1 o'clock at night on a small pavilion built near a waterfall at Khao Chong Forest Station. It was the only specimen taken. Another *Ptychozoon* presumably of this species was discovered near the summit of a small dead tree whose top was broken. The specimen after considerable disturbance from a long bamboo pole took "flight" jumping the gap of approximately 2.5 meters between this and another living tree partly covered with vines and aerial plants. It landed on the trunk at an elevation of perhaps 15 feet lower than the point of departure. The specimen found a hiding place from which I was unable to dislodge it.

The "flight" was unexpected and so sudden that I cannot vouch for the condition of the lateral flaps. It is, however, my impression that they expanded in flight. This species lays two eggs which are at least occasionally plastered on the outside of smooth bark of living trees.

Ptychozoon kuhli Stejneger

FIGS. 31, 32, 33

Lacerta homalocephala (not of Suchow 1798) Creveldt, Mag. Ges. Naturf. Berlin, vol. 3, 1809, p. 267, pl. 8. (Type-locality ?)

Gecko homalocephalus: Tilesius, Mem. Acad. St. Petersburg, vol. 7, 1820, pl. 10.

Ptychozoon homalocephalum: Cantor, Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 626 (*part.*); Günther, Reptiles of British India, 1864, p. 105; Stoliczka, Journ. Asiat. Soc. Bengal, 39, 1870, p. 159; Baur, Proc. Zool. Soc. London, 1885, p. 718; Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, pp. 190-191 (*part.*); The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, pp. 104-105, fig. 31 (*part.*); Fasciculi Malayenses, Zool. 1, 1903, p. 150; Journ. Federated Malay States Mus., vol. 3, 1908, p. 64; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, pp. 52-53; De Rooij, Reptiles of the Indo-Australian Archipelago, Leiden, vol. 1, 1917, p. 58.

Ptychozoon kuhli Stejneger, Proc. Biol. Soc. Washington, vol. 15, 1902, p. 37 (new name); Mertens and Senfft, Nat. und Mus., Frankfurt am Main, vol. 59, 1929, pp. 218-224, figs. 1-4; Mertens, Blatt. Aquar. Terrar.-k, Jhr. 40, 1929, Heft. no. 6, p. 104; M. Smith, Bull. Raffles Mus., no. 3, Apr. 1930, p. 19; The Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 117-118, fig. 34; Tweedie, Proc. Zool. Soc. London, 1950, vol. 120, p. 13 (Pl. 1, photo); Bull. Raffles Mus., no. 25, 1954, p. 107-109, pl. 1, text fig. 1.

Diagnosis: Body flattened; skin-flaps present on side of head, front and posterior part of arms, front and posterior part of legs, on side from axilla to groin, on sides of tail; toes webbed, widened lamellae under digits undivided; terminal joints and claw absent from inner digits; preanofemoral pores, 21-26. Dorsal tubercles with several irregular rows of large flat rounded, or somewhat conical tubercles intermixed; tail segments with a transverse series of six (basally), four or two enlarged conical or trihedral tubercles intermixed with smaller scales of tail segments. Lateral body flap with separated lines of scales on its underside; a very short indistinct suture enters upper edge of rostral.

Description of species (from 35537, collected approximately 10 km. west of Nakhon Si Thammarat, May 3, 1958): Rostral nearly quadrangular (5 mm. x 2.2 mm.), with a short groove or suture entering from above, scarcely more than .3 mm. in length; rostral borders first supralabials and a pair of widened supranasals; nostril surrounded by rostral, anterior supranasal, a posterior supranasal, first labial, and a postnasal; anterior internasals form median suture, each bordered posteriorly by three scales, median pair largest; about 30 scales in a row across snout between third labials; approximately 64 scales between seventh supralabials across snout; supralabials, 13, posterior ones very small, and followed by a row of eleven or twelve small scales to angle of mouth; infralabials thirteen, anterior ones much larger than supralabials, reducing in size posteriorly and followed to mouth-angle by six or seven small scales; first pair of chinshields about twice as long as wide, in contact for over four fifths of their length; second chinshields about half size of first; these followed by three others of about same size; granules on chin and throat, from chinshields to a line in front of shoulders, about 100; from this point to vent about 105 scales on median line.

Scales on head variable in size, largest on frontal region and in front of orbit; smallest scales in occiput, without enlarged intermixed scales; dorsal scales small, subequal on sides, median rows a little the larger, with several rows of enlarged, rounded, sometimes subconical tubercles intermixed, chiefly in posterior part of body; scales on side below skin-flap granular for about 39 rows, while

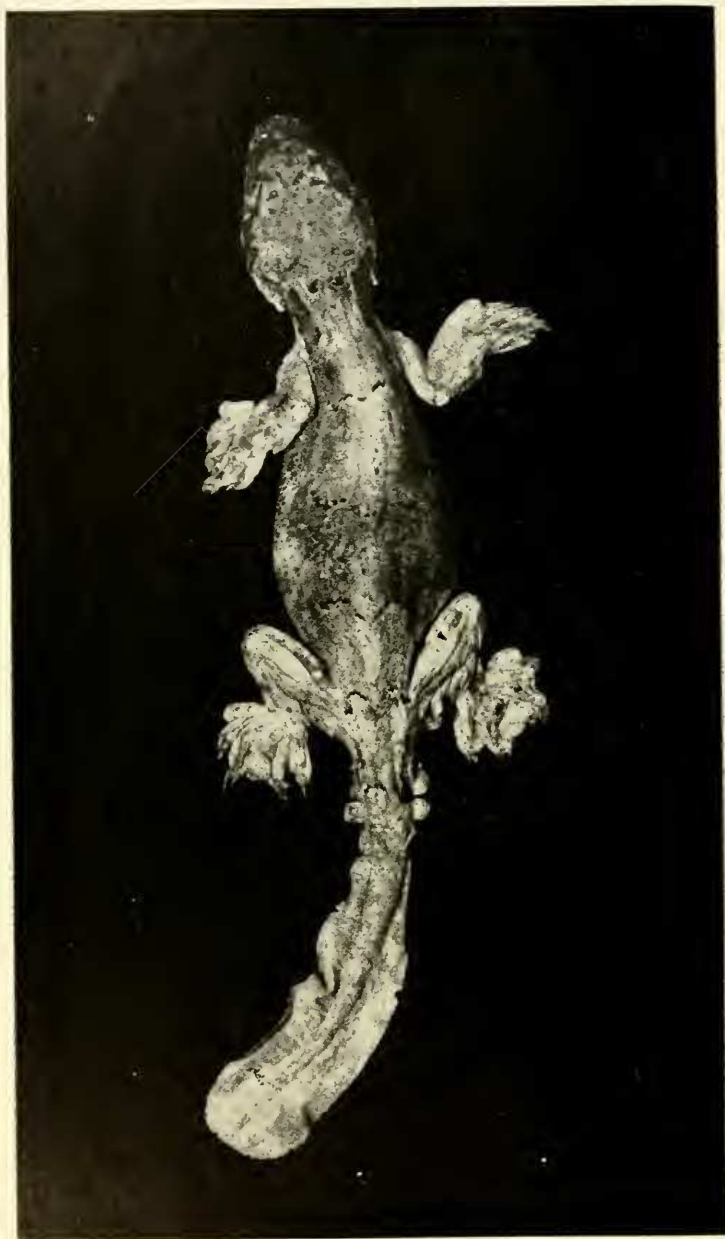


FIG. 31.—*Ptychozoon kuhli* Stejneger. No. 35537, 10 km. west, Nakhon Si Thammarat, city. Actual length, 157 mm.

median ventral 26 to 28 rows of scales, enlarged, flat, cycloid, imbricating; a transverse, slightly angular row of 26 preanofemoral pore-scales, followed by five or six rows of somewhat enlarged preanal scales; tail segmented at base (greater part of tail regenerated and unsegmented) (normally segmented throughout); upper part of tail segments normally with 12-13 irregular rows of small scales, intermixed with six (four, or two on distal parts) enlarged trihedral or conical tubercles in a transverse row; subcaudal scales enlarged, about five rows to each segment subcaudally, median series partly paired or partly irregular.

Scales above ear-flaps about size of, or a little larger than, ventral scales, with smaller scales on under surface of flap; lateral body flap, 15 mm. wide; above, scales arranged in transverse series, the undersurface largely without any scales; basal part of tail with each segment bearing a small separate flap standing at right angles to axil of tail. (Normally at least 17 segments show scallops) but the terminal part of the tail (latter third or fourth) forming a widened flap.

The regenerated tail has a continuous flap, narrow proximally (9.5 mm.) but growing wider distally on last 30 or 40 mm. of length.

Ear-opening moderately large, its diameter 2.7 mm.; ear to eye, 8 mm.; length of snout, 10 mm.; diameter of orbit, 7.5 mm.; lamellae under digits widened distally, undivided, basal part with eight or ten scales; total scales and lamellae, 25 under fourth finger, 31 under fourth toe.

Color in life: Above brownish to gray-lavender with a series of blackish spots across nape of neck, and with a longitudinal series of dark flecks back to above arm-insertion; four narrow sinuous marks across back usually bordered by black on anterior edge; chin, throat, and venter dirty white somewhat darker under thighs and subcaudal region; head nearly uniform gray-brown above; lateral flaps with indefinite blackish color proximally; ear-flaps much lighter than other skin appendages.

Measurements in mm. (of Nos. 35537 and 35631*: Snout to vent, 94, 32; tail, 63 (regenerated), 27.4; total length, 157, 59.4; snout to arm-insertion, 34.6, 16; axilla to groin, 42, 14; head width, 19.6; 8.7; head length, 28, 12; arm, 37.5, 11; leg, 41, 15; width of body-flap, 17.2, 4.5.

* Two biscuit-shaped eggs of this species were discovered plastered behind a small board, nailed on a tree. The eggs measured approximately 16 x 16 x 6.8 mm.; both were broken when they were being removed. An embryo measuring about 59.4 mm. was removed from one of the eggs, a mass of yolk remained. The animal had the characteristic gray and black markings of the adult. They would appear to be larger on hatching than the young of *lionatum*.

Variation: The supralabials vary between 11 and 15, the infralabials between 10 and 13. The enlarged tubercular scales may extend as far forward as the occiput. The preanal pores vary between 20 and 26.

Distribution: *Ptychozoon kuhli* has been taken at Bukit Besar (near Na Pradoo), Pattani; and 10 km. E of Nakhon Si Thammarat. The species is known in Malaya, in Sumatra, Borneo, Java, and the Nicobar Islands. *Ptychozoon horsfeldi* has been taken at Penang, Malaya, and probably may occur in southern Thailand.



FIG. 32.—*Ptychozoon kuhli* Stejneger. Khao Chong Forest Experiment Station, Trang province, Thailand. Embryonic specimen taken from egg. Actual total length, 59.4 mm.

Remarks: The female specimen described was found in a dark narrow crevice between two close-growing branches. It was routed from this place by aimless probing into the crevice with a small strip of bamboo. There are two large eggs in the body presumably nearly ready for deposition.

Malcolm Smith has commented that *lionatum* is very closely allied to *P. kuhli*. "I have examined seven specimens including the types. The preanal pores vary from 16 to 25 in number. The coloration is variable and much as in *P. kuhli*."

The specimen which I have described as *lionatum* occurs in the same area as *P. kuhli* and they very probably will be found to occur together.

There are several characters in which *P. kuhli* differs from *lionatum*.

1. Presence of enlarged dorsal tubercles (none in *lionatum*).
2. Widening of the terminal tail flap (narrowed in *lionatum*).
3. Slightly different slant of the caudal scallops.
4. The lateral flap considerably wider, sometimes twice as wide.
5. Tail with six (basal segments), four or two large trihedral tubercles on tail segments (none in *lionatum*).
6. The rows of ventral granular and cycloid scalerows number about 106 (about 68 in *lionatum*).
7. The supranasals are in contact (separated in *lionatum*).
8. Conical tubercles in transverse rows on each tail segment; (no conical scales in *lionatum*).

There are many other less obvious differences. Thus it seems certain that these forms merit specific distinction.

The tail of No. 35537 has been regenerated for more than half its length without evidence of segmentation.

Addenda: A specimen of *Ptychozoon* from the high mountains of Chiang Mai, cannot be properly allocated since it lacks a tail; as no Thai specimens are known in that region it may represent an undescribed race or species (figured).

FAMILY AGAMIDAE

The populous family of the Agamidae has its counterpart in the family Iguanidae. Often a genus of one of the families appears to take on the characteristics of a genus of the other so that superficially it may be difficult to determine its true relationship. Many authors have commented on this.

Opinion seems to be divided as to whether these resemblances

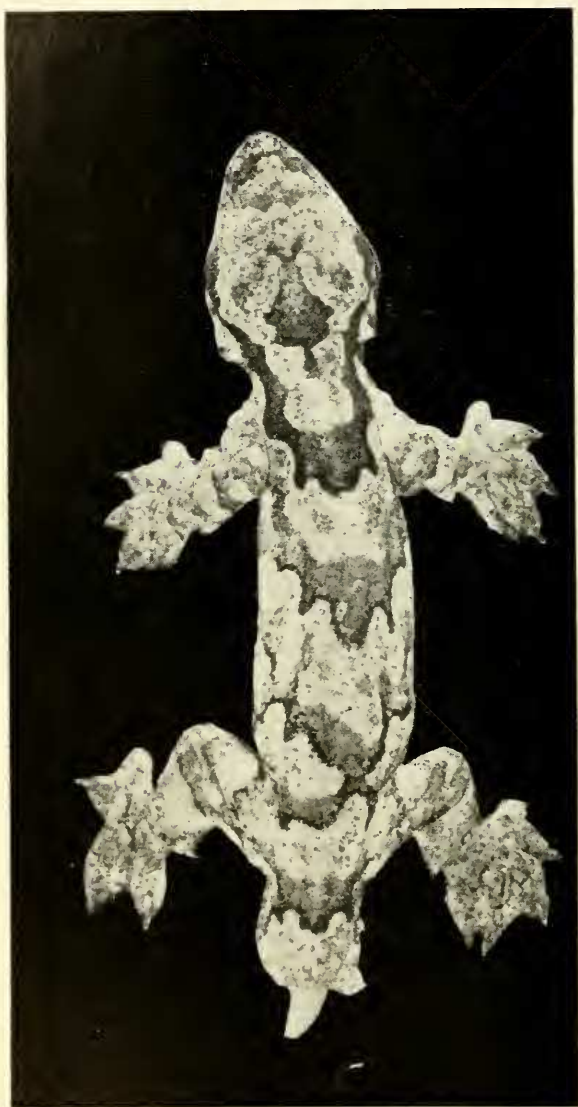


FIG. 33.—*Ptychozoon* sp.? EHT-HMS, No. 265. Photo of a specimen lacking tail, from the high mountains of northern Chiang Mai. Without the tail its identity cannot be satisfactorily established. Collected by Oliver Gordon Young, 1961.

are because of a close relationship of the families or because of some inherent pattern in heredity or adaptation. The Agamids are largely confined to Asia, Australia, and Africa; the Iguanidae to the Western Hemisphere. However, there are some anomalous facts. The Agamids, while present in Africa, are absent in Madagascar and New Zealand, which represent breaks in the continuity of their distribution. The Iguanids have a continuous distribution in the Western Hemisphere but they also appear in Madagascar and certain islands in the Pacific.

The dentition of the two families differs and is perhaps the major character for warranting familial differentiation between the two groups.

Only a few genera (*Physignathus*, *Uromystax*, and *Leiolepis*) have the typical femoral pores of lizards. While of different origin and structure, species of certain genera have in the preanal region or on the posterior part of venter, callose scales with epithelial tissue that accumulates and which can be removed from the scale, leaving a pit.

Adaptations to habitats are marked. Slow-moving terrestrial forms usually display short legs and a flattened body; arboreal forms have the bodies compressed with a tail often three to four times greater than the length of the head and body. Certain fast moving terrestrial forms have the legs greatly enlarged and bipedal movement is often assumed. An elongate tail is present, and curled up high appears to serve as a balancing organ when the animal is running in a bipedal manner.

One curious habit of a number of species of agamids is that after a hole is dug for deposition of eggs, the earth used to cover the eggs is pounded using the head as a pile-driver.

While most forms lay leathery eggs that have the oval shape of most reptilian eggs, some species of certain genera (*Calotes*) may lay spindle-shaped eggs. The eggs of certain species of *Draco* have a tiny terminal shelf at one end.

Unlike in many genera of the Scincidae and Teiidae there is little tendency for the competition for food between two species, to drive the weaker competitor underground, with the consequent loss of digits and limbs. In this family practically all forms are typically pentadactyl. An exception however, is a Ceylonese and Indian genus *Sitana* comprising a single species, which has lost the fifth toe. There are no snake- or wormlike forms.

The food, at least in the smaller forms, is chiefly insectivorous. In a few larger species of the family, *i. e.*, *Lophura* and *Leiolepis*, the animals are at least primarily herbivorous. *Lophura*, which feeds chiefly in trees near streams or bodies of water, has become at least semiaquatic; and often when disturbed takes refuge by diving into water from the trees where they are feeding. They usually swim under water.

In Thailand, *Leiolepis* is often offered in the food markets for human consumption.

The skulls of the Agamidae are well ossified, and the dentition is confined to the jaws, none of them having palatal teeth. The character of the teeth in many but not all species varies somewhat in the manner of Mammalian teeth, and we may liken them to incisors, canines, and molars. The molar series is ankylosed to the bone of the jaw and the teeth themselves may be joined together solidly at their bases forming an uninterrupted row. The canines are distinct and the incisors are more or less fused. The teeth for the most part are not replaced.

There are no enlarged symmetrical head-scales such as occurs in several families of lizards. Nor are there osteoderms as is common in certain families (Scincidae). The head is covered with very numerous scales, the general pattern of their distribution being symmetrical on the two sides. The shape and character of the individual scales vary remarkably. Many forms have small glands in the scales, especially those of the head, and many forms have a fine hairlike process extending back from the posterior part of the scale. In many species the scales are keeled and may bear mucrones.

Seven genera of the family Agamidae are represented in Thailand. Some species at least, have a fairly wide distribution in the country. The exceptions are largely in the genera *Draco*, *Gonioccephalus* and *Aphaniotus*. The last two genera are presumably confined to the southern part of peninsular Thailand, and several of the species of *Draco* are likewise confined to the same area.

KEY TO THE THAI GENERA OF AGAMIDAE

- | | |
|---|--------------|
| 1. Five or six elongated ribs supporting lateral dermal expansions serving as wings for gliding flight; a longer or shorter gular projection (dewlap) at least in males; arboreal | <i>Draco</i> |
| Ribs not supporting a dermal expansion for gliding flight; sometimes a small gular pouch but no typical dewlap | 2 |
| 2. Femoral pores present in males | 3 |
| Femoral pores not present | 4 |

3. Femoral pores (at least in males) four to eight on each side; tail strongly compressed, covered with small keeled scales above, and much larger, more strongly keeled ones below; leg reaches to eye or tip of snout; large *Physignathus*
 Femoral pores (at least in males) 13-21 on each side; tail thick at base somewhat flattened, covered with small equal keeled scales the largest ones in subcaudal region *Leiolepis*
4. Tympanum hidden; no gular fold or pouch; inside of mouth blue, *Aphaniotus*
 Tympanum exposed; mouth lining not blue; small gular-fold sometimes present 5
5. A strong spine arising behind orbit and one on side of neck, *Acanthosaurus*
 No strong spine arising behind orbit, or on side of neck 6
6. Dorsal scales unequal, intermixed with few or many larger irregular scales; a high dorsal crest in males, the crest somewhat lower in females *Goniocephalus*
 Dorsal scales (in Thai forms) nearly uniform, not intermixed with larger scales; body scales regularly arranged *Calotes*

Genus DRACO Linnaeus

Draco Linnaeus, *Systema Naturae*, 1766, vol. 1, p. 358 (type species, *Draco volans* Linnaeus).

Diagnosis: Five or six elongate ribs passing through body wall, supporting a wide membrane continuous with body skin, that may be folded parallel to body or expanded like a fan by rib movements; body somewhat depressed with an elongate tail depressed at base, but usually more or less compressed elsewhere; a gular appendage (dewlap), large in males, small or nearly absent in females; a small winglike membrane bordering side of head and neck (wattles); tympanum scaled or naked; a pair of caninelike teeth in both upper and lower jaws; legs short; no femoral pores.

The genus *Draco*, confined to India, Southeastern Asia and most of the Indo-Australian Archipelago, has no less than thirteen forms in Thailand, where the species have the generic native name of *ginka bia*, this name being applied to all of the various forms.

The habits of the various dracoes do not seem to differ greatly. They usually are seen on tree trunks, the head pointed upwards, the body usually vertical, if at rest. The wings are usually folded except when in the air, although, the wing may be expanded during courtship, or during the process of shedding. Thus a specimen was seen after a shower expanding the wings to extreme capacity and holding them so for several seconds, then folding them. This was done a number of times. When the specimen was later captured, it was seen that the epidermis was broken in literally hundreds of

places the tiny patches producing the effect of whitish spots over the surfaces of wings and body. When dry the epidermal fragments were loose enough to be removed by the wind.

Some of the general structural characteristics are: enlarged scales above the nuchal wings (lappets or wattles); larger keeled scales on the front surface of the shoulders; frequently, but not invariably, a row of enlarged keeled separated tubercles, single or in small groups on the dorsum along the base of the wing-membranes; on the back edge of the thighs there is a series of enlarged, compressed overlapping scales which extends onto the adjoining edge of the tibia.

In the males of several species there is a longitudinal nuchal fold extending posteriorly from the back of the occiput for a variable distance on the neck. Sometimes some or all of the scales on the upperpart of the fold are serrate, sometimes not. The caudal crest, present in males of certain species, begins just behind the level of the vent, and continues along the median line of the dorsal surface of the tail, the scales forming distinct serrations. The nuchal and caudal crests attain maximum size in *Draco punctatus*.

When a median caudal crest is absent in a male there are usually two rows of slightly serrate scales on the dorsal surface of the compressed part of the tail. In species with caudal crests the females usually have three equal rows on the dorsal surface.

The insect food of the various species is seemingly extensively varied. However, certain forms in the Philippines would appear to feed almost exclusively on ants.

In many species four eggs are laid (*fimbriatus*, *taeniopterus*, *volans*, *formosus*, *maculatus*, etc.) but whether this is a fixed number for these and for certain other species, I do not know.

Draco melanopogon, on the other hand, presumably produces only two eggs. It is a smaller, slenderer species.

The wing may be described as being like a fan; the ribs penetrate the body wall remaining between two layers of skin which form the membranes of the wing. When the ribs are folded back, the wing is closed like a fan along the side of the body. The wings are used for gliding, the animal not being able to raise and lower the wing in the manner of a bird. The animal loosens its hold and starts to fall as the wings are opened. It may land at a lower point on the same tree trunk or on another tree, gliding a considerable distance if its goal is at a distance, changing direction when necessary to reach a particular tree.

The frequency with which a male and female are found together suggests that their mating may be a permanent one. Sometimes a male and female will leave a tree when disturbed and both alight close together on a tree twenty to fifty meters away. Occasionally when a female is near and the male is disturbed he will extend the dewlap and display its distinctive coloration several times. I have noted this particularly in a *Draco fimbriatus* although occasionally I have seen the same behavior in several other species.

The specimens in the forest are often difficult to see unless they happen to show a body profile at a proper angle against the light. Their coloring when wings are folded, blends with that of the tree so that in the forest light they cannot be discerned easily.

The appendage on the throat sometimes called a gular "pouch," is here called a dewlap, and the lateral nuchal wings are referred to as lappets or wattles for the sake of brevity.

The inverted Y-shaped series of scales on the snout may not be discernible in certain individuals of a species where it normally occurs. Other species where it does not normally occur may have a longitudinal series of two or three keeled scales on the median line of the snout.

The species when taken alive are very prone to bite, the sharp caninelike teeth usually penetrating the skin and in the case of the larger species, the bite can be painful. Contrary to certain beliefs, none of the species has a voice, and they make no calls of any kind.

The distribution of *Draco* in Malaya, Borneo and Sumatra shows that of the Bornean fauna of some 16 species, no less than eleven are common to the Malay Peninsula and seven also occur in Sumatra.

All species known in Malaya have been taken in Thailand except *Draco maximus* and this so far as I know occurs chiefly in the southern part of Malaya. It is known in Selangor and is relatively common in parts of Pahang. It should be looked for in Thailand.

KEY TO THAI SPECIES AND SUBSPECIES OF DRACO

- | | |
|---|----|
| 1. Nostrils lateral, directed outwards | 2 |
| Nostrils dorsal, directed upwards and often slightly backwards ... | 6 |
| 2. Tympanum covered with larger or smaller scales | 3 |
| Tympanum naked (<i>melanopogon</i> and <i>volans</i> occasionally have the
tympanum at least partially covered with scales) | 4 |
| 3. No blue spot * on each side of base of dewlap | 3a |

* The key given by Taylor and Elbel *loc. cit.* should read,

3. No blue spot on each side of base of gular appendage (dewlap)	4
A blue spot on each side of base of dewlap	5

- A blue spot on each side of base of dewlap 3b
- 3a. No spaced series of enlarged pyramidal or trihedral scales on side of neck continuous with spaced series at base of alar membranes; no caudal crest evident; a short nuchal crest, only the first three or four scales distinctly enlarged; underside of alar membranes yellowish with one or two black spots; to 87 mm. *maculatus maculatus*
- A spaced row of enlarged trihedral scales on sides of neck continuous with spaced series at base of alar membranes; a small caudal crest evident; a nuchal crest involving 20-25 scales; underside of alar membranes yellow with numerous black spots; to 70 mm., *maculatus divergens*
- 3b. No series of pyramidal or trihedral scales along side of neck; alar membranes unicolor below lacking dark spots; base of dewlap deep orange; snout to vent 65 mm. *maculatus haasei*
- A series of pyramidal or trihedral scales on side of neck, curving above arm, continuous with the enlarged scales at base of alar membranes; nuchal crest barely indicated; dewlap blue at end, red behind its base; underside of alar membrane unspotted; to 86 mm., *maculatus whiteheadi*
4. Undersurface of wing bluish or ultramarine with rather ill-defined transverse series of irregular black spots; an inverted, Y-shaped series of enlarged keeled scales on front part of head; no caudal crest *volans volans*
- Undersurface of wing variable, but lacking transverse rows of black spots 5
5. Caudal crest present in males 6
- Caudal crest absent in males 7
6. Dewlap of male saffron or orange, much longer than head; caudal crest present but not strongly defined *fimbriatus fimbriatus*
- Dewlap of male chrome-yellow, about same length as head; a very distinct nuchal crest; caudal crest with rather long vertically pointed scales *punctatus*
7. Wing red, with five regular curved transverse dark bands each with a transverse row of small white dots, as wide as the intervening red spaces; a black band crosses underside of neck; narrow transverse blackish bands on undersurface of wing; body above dotted with blackish *quinquefasciatus quinquefasciatus*
- Body and wings not so colored 8
8. Dewlap deep black, longer than head; a light whitish or ultramarine posterior part; wings black dotted with numerous small yellow spots *melanopogon*
- Dewlap not black 9
9. Smaller species 75-85 mm. No caudal crest 10
- Larger species 100-125 mm. A caudal crest 11
10. Scales on head very small, subequal on snout; dewlap about as long as head in males, covered with moderately enlarged scales; no maroon or magenta color on wing. *haematopogon haematopogon*
- Scales on head varied; an inverted Y-shaped series of enlarged keeled scales on front of head; a broad band of maroon or magenta on back part of wing; unspotted below; dewlap rounded, distally covered with large translucent scales *taeniopterus taeniopterus*

11. Distal two thirds of dewlap covered with large translucent scales; wings above olive or yellow-olive with fine lighter parallel longitudinal or slightly curving lines; orange to scarlet under wattles; immaculate yellowish under wing *blanfordi*
 Dewlap with large translucent scales. A caudal crest; wing membranes with irregular indefinite transverse dark curving bands; a broad band of maroon or magenta along back border, *formosus formosus*

Draco maculatus Gray

Four subspecies are recognized (see key).

Draco maculatus maculatus (Gray)

FIG. 34

Dracunculus maculatus Gray, Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 636 (type-locality, Penang Island, Malaya).

Draco maculatus: Günther, Proc. Zool. Soc. London, 1861, p. 187, The reptiles of British India, 1864, p. 125, pl. 13, fig. C (a Siamese specimen); Anderson, Anatomical and zoological researches . . . results of the two expeditions to western Yunnan in 1868, and 1875, London, 1879, p. 802; Blanford, Journ. Asiat. Soc. Bengal, 1878, p. 125; Boulenger, Catalogue of the lizards of the British Museum, vol. 1, 1885, pp. 262-263; *ibid.*, p. 492; A vertebrate fauna of the Malaya Peninsula . . . Reptilia and Batrachia, 1912, p. 58. M. Smith, Journ. Nat. Hist Soc. Siam, vol. 2, Dec. 1916, p. 152 (Klong Wang Hiep, Nakon Si Thammarat); *ibid.*, vol. 2, June, 1916, p. 52; Bull. Raffles Mus., No. 3, 1930, p. 21; Taylor, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, 1934, p. 290; Hennig, Temminckia, vol. 1, 1936, pp. 211-213, map 12.

Diagnosis: A moderately small species (to 85 mm. snout to vent); head small, nostril lateral, directed outward; tympanum scaly; a prominent scale on back part of supraciliary edge; wing-membranes of male usually orange with numerous spots; a blue spot on each side of base of dewlap.

Description of species (from No. 173, Na Bon Coffee Camp, Nakon Si Thammarat): Head rather small; rostral three times as wide as high, bordered behind by five scales and laterally by two labials; nasals craterlike, directed outward and slightly upward, separated from rostral by two rows of scales; separated from each other by six rows; scales on top of head variable in size, shape, degree and character of rugosity; scales in canthal area on front part of supraorbital area, and on inner dorsal part of supraorbital area, largest; canthal scales continued on front half of supraciliary border, then, after a short break filled with small scales, a larger compressed tubercular scale on posterior part of supraciliary region; at posterior upper edge of orbit, a strong conical tubercular scale; occipital scales large, some strongly rugose.

Supralabials eight or nine, not keeled; a series of three en-

larged scales form a ridge behind eye, third compressed, elevated; tympanum covered with eight or ten small scales; mental with a labial border about equal to that of rostral; ten infralabials, last small; a small nuchal crest, low, indistinct, except for two or three larger compressed scales at beginning, behind occiput. A high tubercular scale a little above tympanum; scales on outer part of wattles enlarged, keeled, the keels directed downward and back-

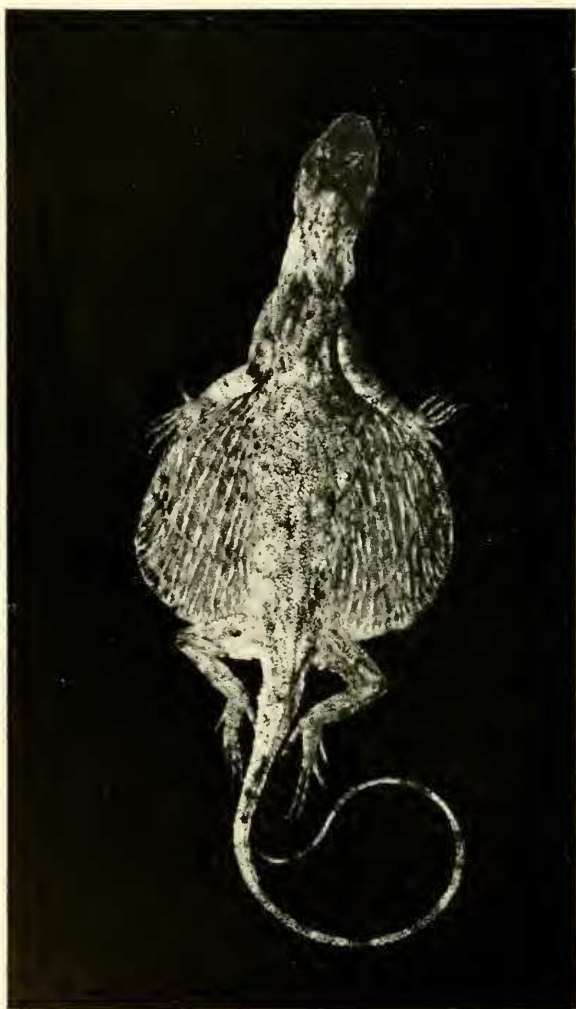


FIG. 34.—*Draco maculatus maculatus* (Gray). Khao Chong Forest Experiment Station, Trang province, Thailand. Actual length, 190 mm.

ward. Dewlap of male large (26 mm.), much longer than head (18 mm.), the terminus moderately attenuate, and covered with somewhat enlarged scales on anterior edge; scales on back moderately large, a little smaller on sides. Ventral scales a little larger than dorsals and strongly keeled. A spaced row of large tubercular scales at base of wing-membranes; wing-membranes moderately large; tail with a median dorsal serrate crest highest somewhat behind base; postfemoral fringe of scales rather weakly developed, as are lateral caudal scales; leg does not reach elbow of adpressed arm; five ribs support wing-membranes.

Color in life: Wing-membranes above orange to orange red; very fine indefinite parallel lines of pinkish yellow growing yellowish cream near body follow lines of slightly enlarged granules of wing; black spots covering wing tending to form five or six transverse curving series and at the same time spots (unequal in size) tend to form slightly diagonal parallel rows running from body to near periphery of wings; arms and legs indefinitely marked; digits distinctly banded; twelve rather darker bands surrounding tail; five discrete black spots on neck with a broad chevron-shaped band across shoulders; chin covered with fine black punctations; a bright-blue spot on each side of base of dewlap, the latter with front, sides and terminal parts pearl-gray; under parts yellow; yellowish or yellowish white under lappets; undersurface of wing-membranes magenta with two or three black spots on outer part; venter dirty white with greenish reflections and some minute blackish dots.

Measurements in mm.: Snout to vent, 87; tail, 138; total length, 225; snout to arm-insertion, 28.5; axilla to groin, 46; head length, 18; head width, 11.5; length of dewlap, 26; wingspread, 76.

Variation: The variation is considerable in this form. At Na Bon, in a small lot of coconuts, there was a population that had bright yellow-orange wings, only the proximal parts being covered with small black dots, the black spots on the outer under periphery large. The nuchal markings are dim or absent. The front of the head is dark with a gray frontal mark and a broken gray band across back part of the orbit. The males and females are colored alike. The largest of several specimens is 74 mm. snout to vent. While there was no typical Y-shaped frontal series of scales, a group of large keeled scales formed a V-shaped series (this area has perhaps suffered an injury in the described specimen and the series is incom-

plete); however several specimens do show a poorly defined or well-defined Y-shaped series.

Distribution: The limits of the range of the typical form of *Draco maculatus maculatus* is difficult to define. The specimen described is from an elevation in the mountains of about 300 to 400 meters and is relatively close to the type locality (Penang, Malaya \pm 200 km.).

Draco maculatus divergens Taylor

FIG. 35

Draco divergens Taylor, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, June 13, 1934, pp. 291-292, pl. 17, fig. 4 (type-locality Doi Suthep Mountain, Chiang Mai; the original locality was given only as Chiang Mai, the Doi is some 5 kilometers from the city, and it was here at an unknown elevation that the specimen was taken).

Draco maculatus: Taylor, *ibid.*, p. 290.

Diagnosis: A small draco, characterized by having nostrils lateral, but directed somewhat upwards; tympanum concealed by scales; a compressed spine in the posterior superciliary edge; a pair of prominent conical scales at upper posterior corner of the orbit; a prominent nuchal crest composed of small scales (about 25) the two or three anterior more prominent than others; gular appendage narrow, lanceolate, terminating in a greatly attenuated point, covered with large, strongly imbricated scales. Arm extended forward tips of fingers reach beyond snout; leg extended, toes reach axilla. Grayish mottled darker above; wings pinkish, with dim spots and lines; below large scattered dark spots; gular appendage dark; somewhat greenish orange at base with two small blue spots not extending onto lateral nuchal appendage. Row of enlarged scales behind shoulder.

Description of species: Head moderately large, distance from tip of snout to orbit very slightly less than length of orbit; lateral profile from top of orbit to rostral nearly a straight line, slightly broken in region of forehead by a slightly raised area on forehead; rostral large, smooth, twice as wide as high, bordered by seven scales. Nostrils lateral, directed outwards and upwards, separated from rostral and first labial by a single scalerow, from each other by six rows; rostrum constricted behind nostrils; loreal region concave; labial region forming a broad shelf; a double row of keeled or trihedral scales from nostril to orbit; anterior supraciliary border with one large keeled scale followed by three (or two) keeled scales, the keels directed outward; three larger keeled scales on snout form a

longitudinal row which joins mesially a curved transverse sub-conical or keeled series extending from anterior face of supraorbital region across forehead; a group of scales on supraorbital region enlarged; scales in occipital region larger than other head scales, consisting of a median group of five flanked on each side by a group of five somewhat larger scales, somewhat rugose or trihedrally keeled; posterior supraciliary edge with a compressed spinelike scale; posterior border of orbit with a pair of bluntly conical scales;



FIG. 35.—*Draco maculatus divergens* Taylor. From Taylor, Acad. Nat. Sci. Philadelphia, vol. 86, 1934, pl. 17, fig. 4.

a group of postorbital scales from orbit to above anterior edge of tympanic region; posterior scale subconical; another prominent conical spine directly below this, and another larger, conical scale preceded by a smaller scale directly behind it, the three forming a triangle including tympanic area. Series of enlarged, distantly spaced scales begin on sides of neck, and continue to base of tail, along base of wing-membrane, scales more numerous and smaller anteriorly; scales on lateral gular appendage larger than dorsal scales, and strongly keeled; on either side of back behind shoulders a row of distant keeled scales terminating before reaching the middle of body. Scales on the back smooth or weakly keeled; wing membranes with numerous diagonal rows of larger scales separated by wider areas of minute scales; crest at dorsal surface of tail low; lateral fringe on base of tail prominent; posterodorsal side of femur with a few groups of larger keeled scales, and a prominent posterior femoral fringe continuous with a fringe on lower part of leg; ventral scales smaller than larger dorsals.

Upper labials 10-11; the row of scales bordering them above only slightly enlarged; nine lower labials, mental less than twice as wide as long, bordered behind by five scales. The gular appendage is elongate, more than once and one-half times the length of head, lanceolate, terminating in a sharp point, covered over most of its surface with enlarged imbricating scales. The posterior edge of gular appendage, instead of presenting a straight edge, tends to form a folded-in pocket at base, and when evaginated forms a pouch-like sack. No nuchal fold.

Color: Above variegated bluish gray with darker markings; a darker area on snout; darker lines on top of head enclose rounded areas in supraocular region; a dim mark borders parietal region, and one across temporal region; nuchal crest brownish, forming a shaft for a deep black arrow-shaped mark on middle of neck; a deep black line across shoulders and indefinite darker markings on back; tail indefinitely banded with lighter; limbs banded with somewhat darker marks; fingers and toes barred; wing-membranes somewhat salmon pink with scattered blackish dots on inner half of wing and very narrow lighter marks following enlarged scalerows; under surface with large spots of black, abdomen grayish; gular appendage dirty greenish, with a dim blue spot on either side of orange base; chin flecked with brown.

Measurements: Total length, 174 mm.; tail, 105 mm.; snout to vent, 69 mm.; foreleg, 30 mm.; hindleg, 37 mm.; axilla to groin,

36 mm.; head length, 17 mm.; head width, 11 mm.; snout to orbit, 5.2 mm.; orbit, 5.6 mm.; snout to foreleg, 24 mm.; gular appendage, 27 mm.

Remarks: Taylor *loc. cit.* has compared the species with *volans* incorrectly. The reason for this was the spotting under the wings (which in the type differs from the spotting in *maculatus maculatus*), and because of having at hand a northern Luzon specimen of what was identified as *volans*, with the tympanum covered with small scales. Occasionally specimens of *volans* from the Indo-Austrian Archipelago may have the tympanum covered with small scales.

A confusing factor is that in certain populations of *maculatus* both sexes may have the same general color pattern. In others the spots are in strongly defined transverse rows or bands, especially in females, and their appearance differs greatly from most males. My series of the various subspecies have been too small to determine the significance of this variation.

The second row of enlarged scales arising on the nuchal region and passing straight back is probably the most distinctive character of *divergens* for separating it from the typical form. This character is reported as being present in *m. whiteheadi* which may be easily separated from other subspecies by the dewlap, blue at tip, and red at base.

Distribution: The form is known from northwestern Thailand. Most of the specimens I have seen (8) are topotypes collected by Gordon Young or myself.

Draco maculatus haasei Boettger

FIG. 36

Draco haasei Boettger, Zool. Anz., no. 433, 1893, p. 429 (type-locality, "Pratchedi," Khao Sebab; Chanthaburi province, Thailand); Taylor, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, 1934, pp. 288-289; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1088-1089.

Draco maculatus haasei: M. Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, 1915, pp. 239-240; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 4, no. 2, Mar. 1921, pp. 93-94 (Pulo Condore).

Draco maculatus: M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 138-140 (*part.*).

Diagnosis: Related to *Draco maculatus maculatus* but differing chiefly in lacking a blue spot at the base of the dewlap; smaller size; scales on the wattles proportionally larger than in *maculatus*; base of gular appendage deep orange, without blue spots.

Description of species (from type-description): Head small; snout a little longer than diameter of orbit; nostril lateral, directed

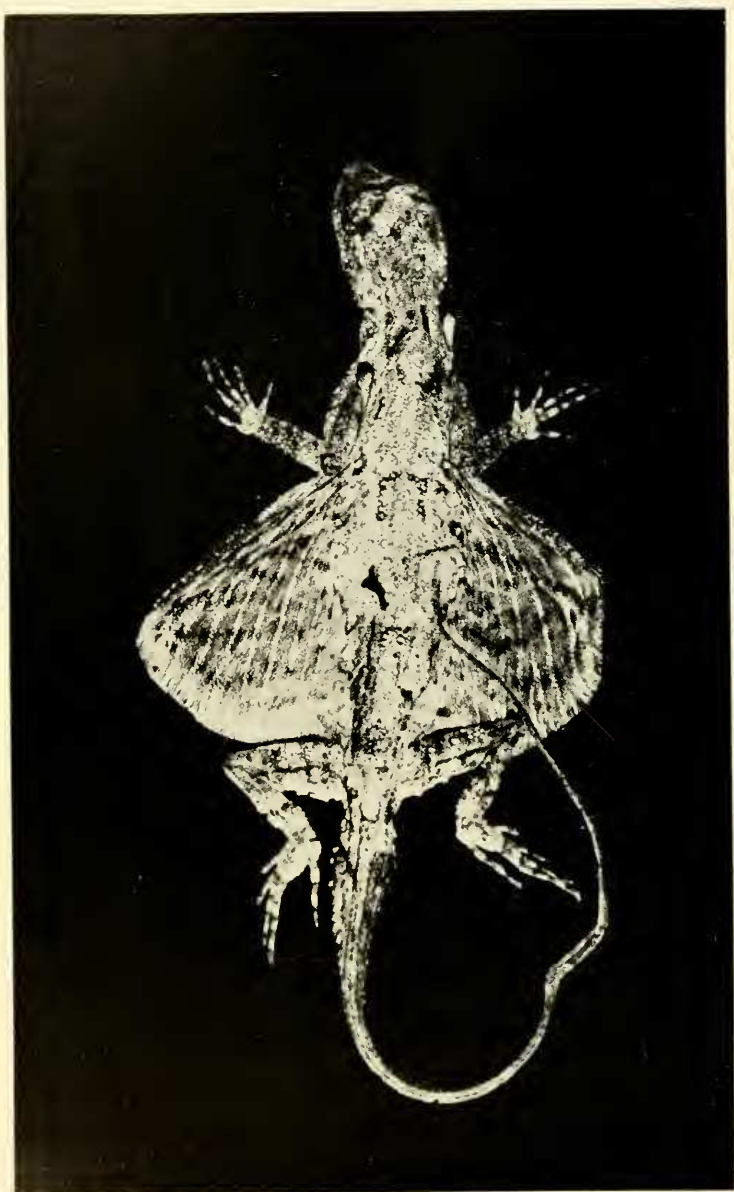


FIG. 36.—*Draco maculatus haasei* Boettger. No. 759, Sanoi River Forestry Station, Ubon province. Total length, 162; snout to vent, 64 mm.

outwards; tympanum scaled; upper head scales large, weakly keeled; a pair of scales on supraocular region distinctly enlarged, much larger than supralabials; a distinct compressed or conical scale at beginning of last third of supraciliary arch and a second broader and shorter one at end of supraciliary region; eight supralabials; gular appendage of male long, nearly twice head length, covered with scales which are somewhat larger than the ventral scales; upper side of lateral nuchal expansions covered with very large, strongly keeled scales, larger than supralabials and largest back scales. A very short and low nuchal crest consisting of eight scales; scales of back irregular, of very dissimilar form and size, largest reaching twice size of sharply keeled ventral scales, and with obsolescent keels or lacking keels altogether. On each side of the back and especially distinct in posterior part, a row of large trihedral keeled scales separated rather widely; arm laid forward reaches well beyond tip of snout; hind leg reaches axilla.

Color: Above coppery-red with metallic reflections and marked with blackish dots, those on neck arranged symmetrically; triangular black interorbital spot; wing membrane delicate orange with whitish longitudinal lines and on proximal half, richly strewn with small round black spots. Underside unicolor and only on anterior point of wing-membrane one or two black spots. Underside of head with brownish reticulation; underside of wattles deep orange lacking dark spots.

Measurements in mm.: Snout to vent, 65; tail, 113; total length, 178; head length, 14; head width, 11; arm, 28; leg, 38; dewlap, 23.

Distribution: Specimens of this subspecies have been taken near the type-locality on Khao Sebab, province of Chanthaburi, at an elevation of about 100 meters. I have also taken it near the city of Ubol.

It is quite probable that the form occurs in Cambodia since the type-locality is close to the Cambodian border.

Draco maculatus whiteheadi Boulenger

FIG. 37

Draco whiteheadi Boulenger, Proc. Zool. Soc. London, Nov. 1899, pp. 956-957, pl. 66, fig. 1 (type-locality, Hainan I.); M. Smith, The fauna of British India, Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 140 (Northern Siam); Hennig, Temminckia, vol. 1, 1936, p. 213-214; Taylor and Ellbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1086-1088.

Diagnosis: Nostril directed laterally; tympanum scaled. Head small, snout longer than diameter of orbit; dorsal scales obtusely

keeled. Similar to *m. maculatus* but "snout longer and coloration different." The dewlap blue at end, red behind its base; wing-membranes brick-red above with small round black spots; colorless and unspotted beneath.

Description of subspecies: Head short, snout slightly shorter than diameter of orbit; rostral less than twice as long as wide, with eight glandular pits on front surface, bordered by two labials and five other scales; nasals craterlike the nostril directed outward, separated from rostral and labials by one row of scales; five or six scalerows separate nasals, snout constricted behind nasals; a Y-shaped series of scales on snout, basal part consisting of two large keeled scales, and the arms of two or three enlarged keeled scales reaching outwards and backwards; supraorbital areas outlined by semicircular series of enlarged irregularly keeled scales separated mesially by three longitudinal series; outer row of supraciliaries very large, keeled; one (or two) large keeled supraciliary scales extending half length of supraciliary border; on middle of latter half of border, a compressed triangular scale, and at posterior border a large compressed tubercular one, flanked by one or two similar scales; six enlarged suboculars more or less continuous with a short series of three pyramidal scales, last two largest; two or three irregular canthals; nine loreal series; supralabials ten, all with two to four pits; an enlarged triangular tubercle between scaled tympanum and angle of mouth; twin tubercles some distance back of tympanum, and another pair above and slightly posterior to tympanum; "occipital" scale narrow, elongate, flanked by groups of five enlarged irregular scales on each side; distal to each of the two groups and slightly posterior a somewhat elevated group of about six irregularly enlarged scales, separated from each other by four small or two enlarged scales; on nape at normal point for the beginning of a nuchal crest two conical scales surrounded by eight scales, altogether forming a rosette. Infralabials 8-8, also bearing pits; mental unpitted its border about equal to rostral border, touched behind by two labials and five scales; gular scales minute; male gular appendage (21 mm.) longer than head (14 mm.), covered on its distal half by large regular scales; lateral nuchal expansions relatively small with larger scales above.

Nuchal crest not or barely indicated; a series of large somewhat compressed pyramidal or trihedral scales begins on neck and curves above arm, then follows along base of wing-membrane

to level of thighs, about 16 on neck anterior to wing, ten or eleven along wing-base; a short indefinite row of similar scales higher up on shoulders; scales of dorsal rows along back much larger than small ventral scales, keeled or smooth, often with their edges raised suggesting lateral keels. A distinct caudal crest; a series

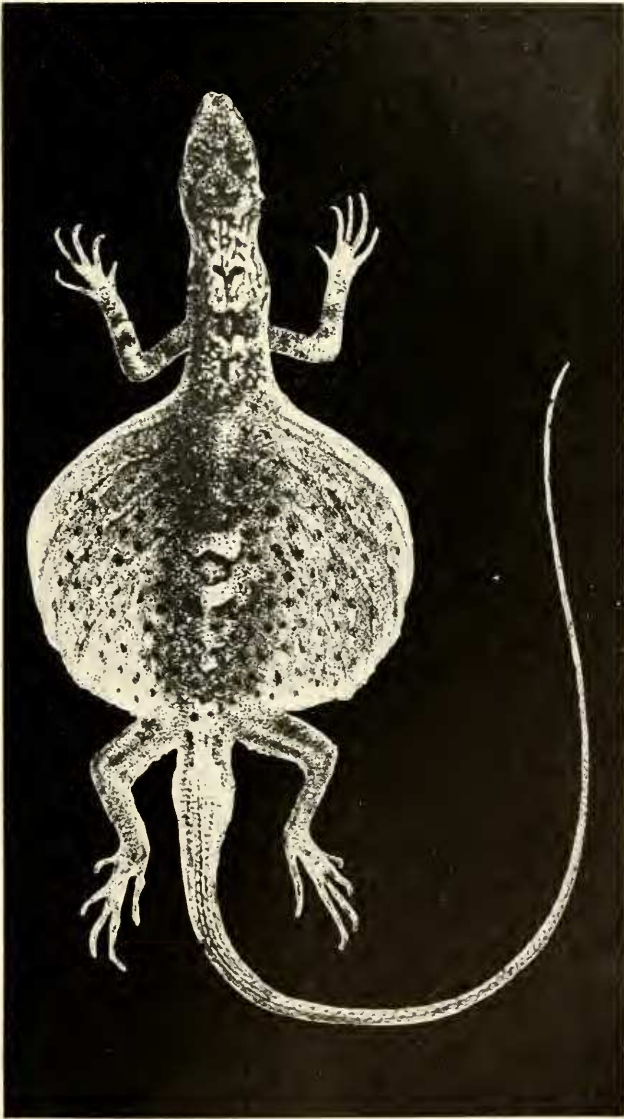


FIG. 37.—*Draco maculatus whiteheadi* Boulenger. From Boulenger, P. Z.S. 1899, p. 95-6, pl. 66, fig 1.

of mucronate scales begins on dorsal part of tail separated at first by three scalerows from caudal crest and more posteriorly comes to border the crest scales; another serrate series that begins on outer edge of base of tail comes later to border the two median ventral series, which have high keels. A fringe of enlarged scales along posterior edge of thigh; front dorsal part of thigh and tibia with enlarged keeled scales; 27 lamellae under fourth toe; scales on breast, on dorsal part of upper arm, and on dorsal part of forearm, enlarged, keeled; posterior edge of forearm with a fringe of larger scales.

Color in preservative: Above brownish, reticulated or dotted with some lighter marks, and with deep black marks on head and neck; wing-membranes light tan with black marbling or flecking, not forming bands or rows of spots; wing-membranes below immaculate gray save for a narrow elongate curved black mark near outer border. Chin darker, speckled with lighter; breast flecked with brownish spots; tail gray, banded with darker to tip; dewlap blackish on anterior margins, remainder whitish, probably orange-red in life; along side of the base of the dewlap are black marks separating the light color of underside of lateral nuchal expansions from that of dewlap area.

Measurements in mm.: Snout to vent, 64; tail, 102; length of head, 14; width of head, 10.5; height of head, 8.5; snout to orbit, 5; snout to tympanum, 12; axilla to groin, 33; arm, 27; leg, 33; length of gular appendage, 21; width of alar membrane, 22.

Remarks: Malcolm Smith (*loc. cit.*) has referred *D. whiteheadi* to the synonymy of *Draco maculatus* (Gray), but mentions the fact that specimens of this form occur in northern Thailand, Hainan and Tongking. The type is 86 mm. snout to vent, the tail, 148 mm.

Draco volans Linnaeus

This species, as reported by Hennig, *loc. cit.*, has four subspecies, only one of which occurs in continental Asia. Hennig has fixed the type-locality in Java, and believes the same form occurs throughout Thailand.

Draco volans volans Linnaeus

FIG. 38

Draco volans Linnaeus, *Systema naturae*, 10th Ed., vol. 1, 1785, p. 199 (type-locality, "India, Africa" restricted by Hennig (1935) to Java); Cantor, *Journ. Asiat. Soc. Bengal*, vol. 16, 1847, p. 643; Günther, *Reptiles of British India*, 1864, p. 124; Boulenger, *Catalogue of the lizards in the British Museum*, vol. 1, 1885, p. 256; *Proc. Zool. Soc. London*, 1890, p. 3; Flower,

- Proc. Zool. Soc. London, 1896, p. 868; *ibid.*, 1899, pp. 603, 636; Ridley, Journ. Straits Brit. Asiatic Soc., no. 32, 1899, p. 191; Laidlaw, Proc. Zool. Soc. London, 1901, vol. 1, p. 307; Volz, Zool. Jahrb. Syst., vol. 19, 1903-04, p. 421; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, pp. 57-58; Baumann, Zool. Jahrb., Syst., vol. 24, 1913, p. 259; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 3, Mar. 1915, p. 153 (Sai Yoke, Kanchanaburi); vol. 2, no. 2, Dec. 1916, p. 152 ("Tan Jong Mas, and Bangnara," Narathiwat province; and Nakhon Si Thammarat); M. Smith, Bull. Raffles Mus., no. 3, Apr. 1930, p. 21 (not found north of Nakhon Si Thammarat); Smedley, Bull. Raffles Mus., no. 6, 1931, p. 104; Brongersma, Zoolog. Meded., vol. 16, 1933, p. 22.
- Draco volans volans*: Mertens Abh. Senckenb. Naturf. Ges., 1930, p. 151; Henning, Temminckia, vol. 1, 1936, pp. 176-179, map no. 2 (details of distribution).

Diagnosis: Small species, snout-to-vent length to 85 mm.; dewlap pointed, as long as, but rarely longer than head; males with nuchal crest; no median caudal crest; wing-membranes above, dark, with transverse darker bands indicated, enclosing lighter spots; bluish below with numerous black spots tending to form transverse bands; tympanum naked; an interorbital black spot; females with a black nuchal spot and usually punctate black spots on back. Wing membranes supported by six ribs.

Description of species (from No. 35722, Khao Chong Forest Experimental Station, Trang province): Head small. Rostral a little less than twice as wide as high, bordered behind by six scales and two labials; nasals lateral, rather small, craterlike, the nostril directed outward and backward; nasals separated from rostral by one or two scales, separated from each other by seven scales, anterior scale above nasal enlarged; snout about as long as orbit; a clearly defined inverted Y-shaped series of enlarged scales on forehead and snout; canthals with compressed edges not extending half way across supraciliary border; a blunt tubercle at posterior edge of supraciliary border, followed by a compressed spine; a pair of blunt tubercles in occipital region separated by three scales; scales on head keeled and somewhat corrugated; three enlarged scales in a longitudinal row behind eye; a distinct nuchal crest, serrate anteriorly; spinelike scale directly above tympanum, and one above and somewhat behind it; tympanum naked; supralabials nine (ten), not keeled; infralabials ten; mental small narrower than rostral bordered behind by two labials and three small scales; dewlap short, pointed, its length equal to head length or slightly longer; an indistinct row of enlarged widely separated keeled scales or groups of scales along base of wing-membranes, dorsally; a fringe of enlarged compressed scales bordering back edge of femur and tibia; dorsal scales of back irregular, some more or less keeled; venter

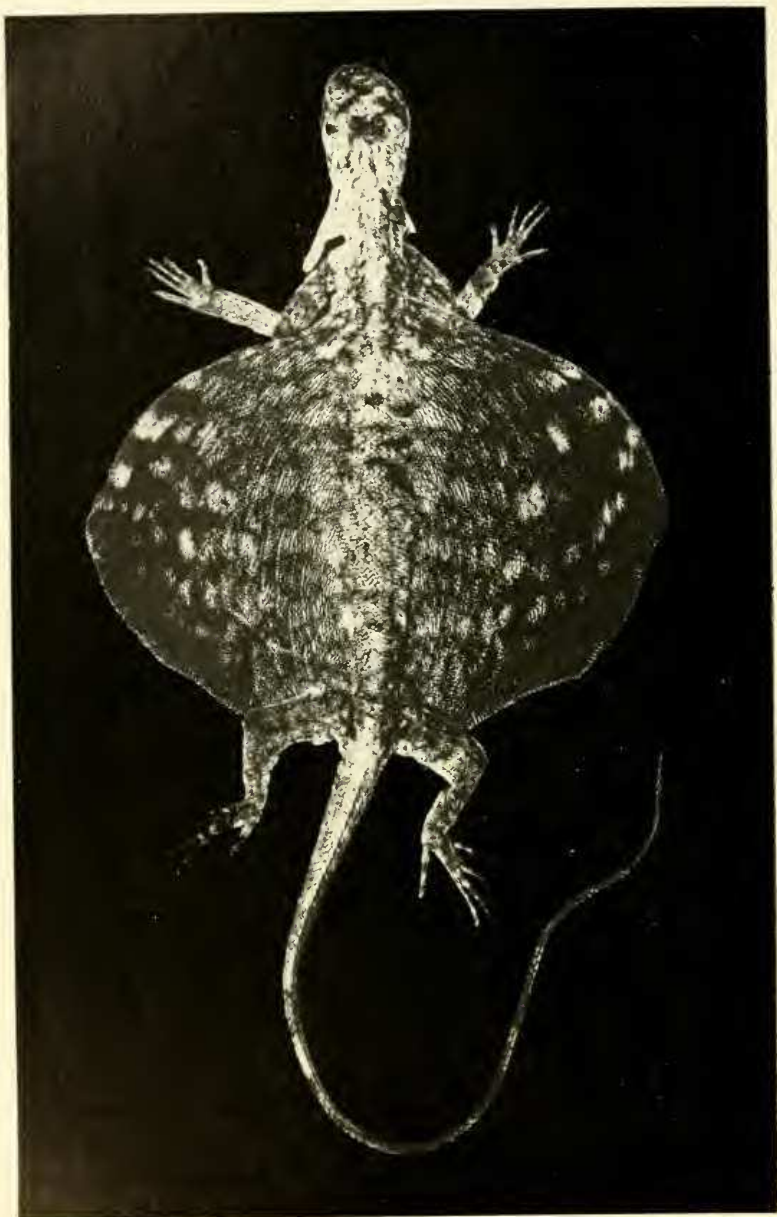


FIG. 38.—*Draco volans volans* Linnaeus. No. 34849, Bhetong, Yala, Thailand. Actual total length, 194 mm.

with keeled scales; no caudal crest. Arm reaching beyond snout-tip; leg reaching elbow.

Color in life: Variegated bronze-brown, olive, black and fawn above with some metallic iridescence; a black interorbital spot with two indefinite dark marks behind orbits; side of head fawn with darker flecks and reticulations; cream-stripe below eye extending onto and nearly across chin; bluish to ultramarine on neck, base of dewlap and underside of wattles; breast and venter bluish, lateral areas with numerous small black flecks the size of single scales. Wing-membranes brown, outer posterior parts black, enclosing lighter brown spots; underside of wing ultramarine with numerous black spots tending to form transverse rows; tail very indefinitely banded; bluish under arms and legs. Dewlap ultramarine at base, distal parts yellowish to flesh-color.

Measurements of *Draco colans colans*

NUMBER	35722	34849	35725	35726
Sex.....	♂	♂	♀	
Snout to vent.....	82	77	77	80
Tail.....	126	117	116	126
Snout to arm-insertion.....	27	24	24	28
Axilla to groin.....	47	48	43	49
Head length.....	18	16	17.5	19
Head width.....	10.9	10.2	10	11
Arm.....	28	25	25	28
Leg.....	32	30	30	30.6

Variation: There is considerable variation in the color of the region about the dewlap. Some specimens have the basal part greenish yellow which may become bluish in fixative; or it may be nearly clay white; there may be a slight greenish wash under lappets. The black flecks (size of one scale) are often arranged together in rows producing a reticulation. Occasionally the breast is bronze in color.

The wing is largely black enclosing brown spots, or distally yellowish-cream or grayish-white spots. The Y-shaped scale series on the snout is presumably always present.

The banding of the tail may be very clearly defined, in some specimens, or scarcely discernible in others.

Distribution: The species is widely distributed in peninsular Thailand. It is known from the following provinces: Narathiwat,

Trang, Nakhon Si Thammarat, and north of the peninsula in Kanchanaburi. It extends into Malaya, the Malayan Archipelago, and reaches as far as Palawan in the Philippines.

Remarks: In 1915 Dr. M. Smith reported *volans* in Sai Yoke district, Kanchanaburi province. In 1930 he states that it does not occur north of Nakhon Si Thammarat. It is possible he changed his opinion as to the identity of the specimen, Sai Yoke being several hundred kilometers north of the southern locality.

Draco fimbriatus fimbriatus Kuhl

FIG. 39

Draco fimbriatus Kuhl, Beitr. Zool. vergl. Anat., 1820, p. 101 (type-locality "in India orientale" restricted to the Malay Peninsula by Hennig); Fitzinger, Neue Classification Rept. Wien., 1826, p. 48; Flower, Proc. Zool. Soc. London, 1899, p. 636; Lidth de Jeude, Notes Leyden Mus., 1904-05, vol. 25, p. 190; Günther, The reptiles of British India, 1864, p. 123; Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 265; Fasciuli Malayenses Zool., vol. 1, 1903, p. 151; Journ. Federated Malay States Mus., vol. 3, 1908, p. 64; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 59; de Rooij, The reptiles of the Indo-Australian Archipelago, vol. I, 1915, p. 79, 80; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916, p. 52; Journ. Federated Malay States Mus., vol. 10, 1922, p. 268 (Gunong Tahan, Malaya); Journ. Nat. Hist. Soc. Siam, vol. 2, no. 2, Dec. 1916, pp. 151-153; Taylor, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, 1934, pp. 289-290 (?Chantaboon = Chanthaburi, Chanthaburi. There is a possibility that this specimen is from a locality other than the one on its label). Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 58, pt. 2, 1958, p. 1084. (The statement "Reported by Taylor (1934) from Chiang Mai," should read "from Chanthaburi.")

Draco (*Rhacodracon*) *fimbriatus*: Fitzinger, Systema reptilium, 1843, p. 50.

Draco fimbriatus fimbriatus: Hennig, Temminckia, vol. 1, 1936, pp. 202-203.

Diagnosis: A large *Draco* with a wingspread of 125 mm.; snout to vent length, 116; tail, 191; male wattles and dewlap saffron to salmon in color with some indefinite radiating lines of gray; underside of wings gray with rather large spots chiefly on distal portions; male only with a distinct nuchal and caudal crest; an inverted Y-shaped series of scales more or less in evidence on snout; nostril directed outward; tympanum naked.

Description of species (from No. 234, Na Bon, Nakhon Si Thammarat): Head large (19 mm. wide, 26 mm. long); diameter of orbit (8 mm.), shorter than snout length (10.5 mm.); a series of three large scales form a median row on snout but branches forming the "Y" are indicated by a single enlarged scale near elevation of orbit (other specimens with the Y-shaped series complete or nearly so); rostral nearly three times as wide as high, bordered behind by two labials and eight postrostral scales; rostral separated from craterlike nasals by two rows of scales; twelve rows of scales be-

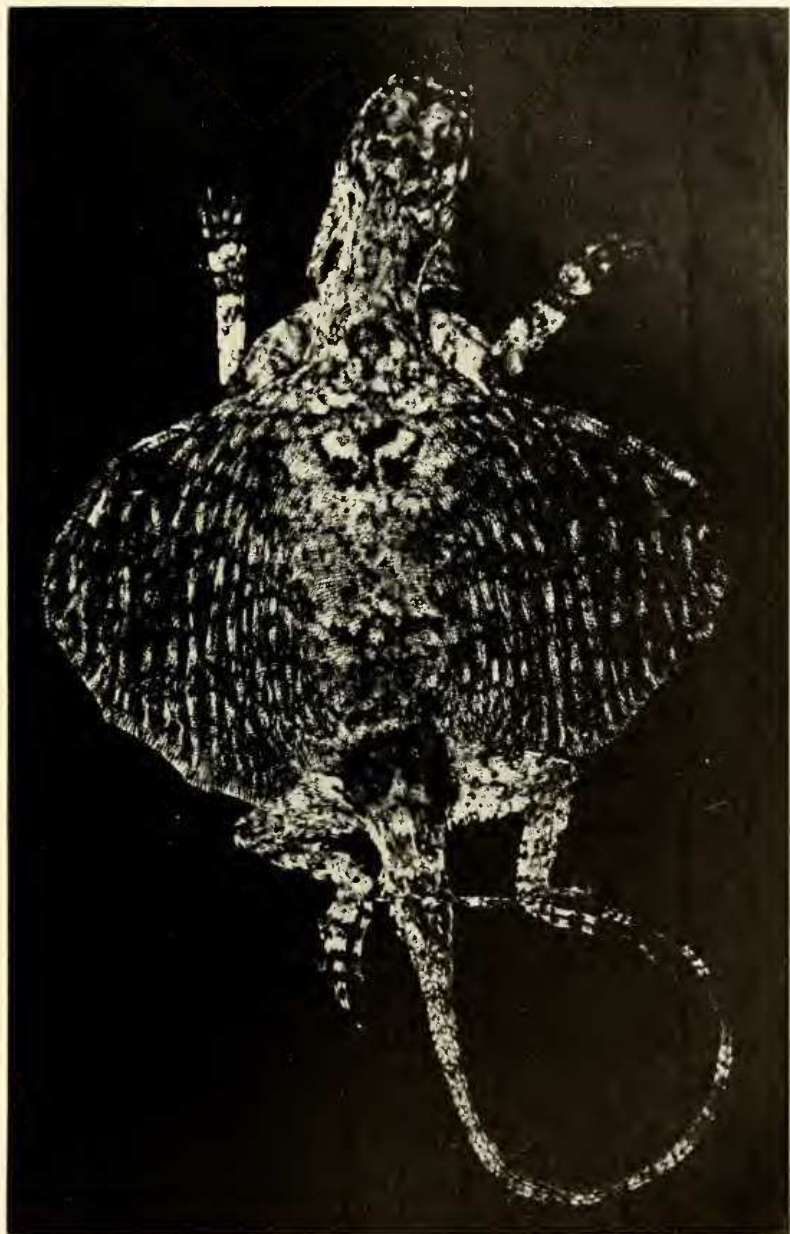


FIG. 39—*Draco fimbriatus fimbriatus* Kuhl. No. 34431, Na Pradoo, (Bukit Besar, near waterfall), Pattani province, Thailand. Actual length, 235 mm.

tween nasals; three or four enlarged canthals, last two above edge of orbit; a pair of blunt spines on each side above back edge of orbit; two groups of enlarged scales on occiput; a nuchal crest extending back to beginning of shoulders, anteriorly elevated, with four or five scalerows on side of crest; tympanum distinct; an irregular row of conical scales above tympanum, and a second row indicated; a much enlarged scale above and anterior to tympanum; supralabials, 12-12; infralabials, 9-13; mental twice as wide as deep bordered by two labials and five small postmental scales; scattered enlarged scales in lower temporal region and on lower jaw, the scales light (cream) in color. Scales on top of head keeled and corrugated; dewlap elongate (35 mm.).

Scales on back rather uniform save for a series of scales in groups along dorsal wing-base, each usually composed of groups of three or four scales with a median one considerably the largest, the groups separated often by half a centimeter; fringe of scales on back of thigh; a well-defined crest beginning near base of tail and continued greater part of length, slight lateral fringe with two much enlarged scales near base. Tail laterally compressed. Scales on venter strongly keeled.

Color in life: Head brownish olive above with black punctations; above on body rich brown with indefinite bands of varying shades; a series of small punctate black spots on occiput, dorsum, and base of tail, most conspicuous of which are three pairs, one on occiput, one on nape, and one on shoulder. Wing-membranes above, grayish with indefinite subparallel gray lines; tail banded with brownish and gray near base, becoming clay and blackish more distally, the bands surrounding tail; limbs bronzy olive above, grayish or bluish white below; dewlap saffron, the color continuous with saffron of underside of wattles; breast and venter cream with very indefinite, darker punctations indicated; underside of wing-membranes gray (sometimes with a yellow wash and black spots larger and more numerous distally); base of tail white below; chin and part of side of head punctate with black and cream.

Variations: The female specimens differ from the males. No. 233 ♀ lacks the black dorsal punctations but instead has a frontal light band with an elongate black interorbital mark; two diagonal black marks on the back of the head; an elongate V-shaped mark and a diamond-shaped mark on shoulders; three more or less angulated spots with four darker lines on tail, the outer connecting with an indefinite dark line from dorsal wing base. The venter has a wash of saffron, stronger posteriorly.

Measurements of *Draco fimbriatus fimbriatus*

NUMBER*	234	174	455	233	165
Sex.....	♂	♂	♂	♀	♀
Snout to vent.....	112	112	99	114	117
Tail.....	181	145+	154	189	162+
Head width.....	18	17.8	16.1	18	19
Head length.....	24.2	23.5	19.8	26	25.6
Snout to arm insertion.....	38	37	34	39	39
Axilla to groin.....	60	59	49	62	64
Wingspread.....	117	114	98	124	112
Dewlap.....	35	38	33	21	20
Arm.....	44	45	40	45	44
Leg.....	48	50	44	51	54

* From, Na Bon Nakkon Si Thammarat.

The dewlap is small (16 mm.) with a slight saffron suffusion extending onto the underside of wattles. The wing-membranes resemble those of males.

No. 165 ♀ is very much darker above but the dorsal markings are very similar to the female, No. 233. The dewlap has no saffron but the dark gray longitudinal marks are visible; the underside of the arms are spotted black, and the yellowish venter is strongly marked with five black punctations. There is no nuchal or caudal crest in the female.

Distribution: The species is known in the southern part of Peninsular Thailand, specimens having been taken in Pattani, Nakhon Si Thammarat, and possibly in southeastern Thailand in Chanthaburi.

Elsewhere it is found in Malaya and in the larger and a few of the smaller islands of the Indo-Malayan group.

Remarks: The females have four eggs in the oviducts. These measure approximately 17 x 9.8 mm. They do not display an angular terminal shelf as is present in *D. blanfordii*.

Draco punctatus Boulenger

FIG. 40

Draco punctatus Boulenger, Ann. Mag. Nat. Hist., ser. 7, vol. 6, 1900, p. 189 (type-locality, Larut Hills, Perak, restricted); Fasciculi Malayenses . . . Zoology, vol. 1, 1903, p. 151, pl. 10, fig. 1; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore . . . Reptilia and Batrachia, 1912, pp. 59-60; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916, p. 53 ("Patani"); *ibid.*, vol. 2, no. 2, Dec. 1916, p. 153 near sea level, "Bangnara, Patani" = Narathiwat, Narathiwat, Thailand); Bull. Raffles Mus., no. 3, 1930, p. 21; Hennig, Temminckia, vol. 1, 1936, pp. 182-183.

Diagnosis: Medium large species, 91 mm. snout to vent; head relatively large; snout as long as diameter of orbit; nostril lateral directed outwards and somewhat upwards; male dewlap a little shorter than head; very distinct nuchal and caudal crests, latter with pointed scales; inverted Y-shaped series of scales on forehead and snout. Grayish with rusty red on top of head and along middle of back; head and back with numerous black dots; membranes of wings black above streaked with whitish; grayish white on underside; dewlap and underside of wattles, chrome-yellow. Six ribs in wings.

Description of species (from No. 35744, Khao Chong, Trang): Head large with a clearly defined, inverted, Y-shaped, series of enlarged keeled scales on frontal region (and snout); rostral about three times as wide as high, bordered laterally by two labials and posteriorly by five or six postrostral scales; nasals large, craterlike, nostrils directed outwards, somewhat upwards and backwards, separated from each other by six scalerows, from rostral by a single scale; snout constricted somewhat behind nostrils; canthal scales compressed and keeled, the series continued backwards to middle of supraciliary border; a moundlike scale at posterior point on supraciliary border, preceded after an interval by an enlarged compressed scale; head scales rugose or keeled, variable in size, those on inner part of supraocular regions and on sides of occiput largest; two or three enlarged scales in a longitudinal row behind eye; tympanum naked with one large compressed scale above, and one behind; supralabials nine or ten with an enlarged scale lying above last; infralabials ten (injured on left side); mental rectangular, labial border about equal to that of rostral, and followed by two labials and five postmental scales; gular dewlap triangular not quite as long as head. A strongly developed nuchal crest; a row of enlarged scales at base of wing-membranes along upper side of body, these scales (or groups of scales) separated by intervals; five ribs support wing-membranes; dorsal scales of body smooth, largest near mid-line, about as large as heavily keeled ventrals. Tail with a strong crest, the crest scales alternating larger and smaller, continued for most of tail-length; a fringe of compressed scales on back of thigh and tibia only moderately developed.

Color: Above greenish with rusty red or brown on top of head and at points on neck, shoulders and back; head on top, side and underside, and dorsal surface of back with punctate black dots of varying size; limbs spotted or banded above; tail with bands of

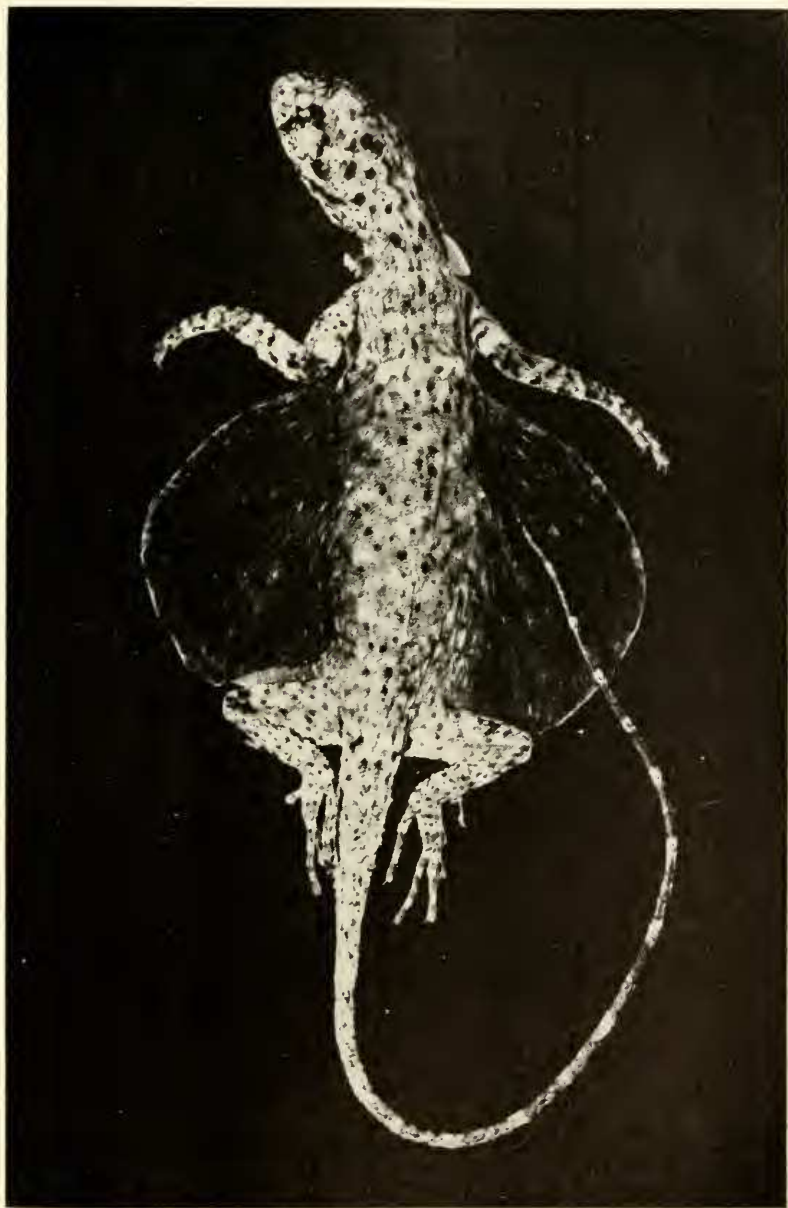


FIG. 40.—*Draco punctatus* Boulenger. No. 35744 Khao Chong Forest Experiment Station, Trang province, Thailand. Actual length, 227 mm.

lighter and dark gray; wings black with fine broken gray streaks tending to parallel body when wings are folded; undersides of wings gray-white to slightly ultramarine without black spots; breast and venter bluish; chin with black and white dots, dewlap and under-side of nuchal lappets chrome-yellow (fading to cream-white).

Measurements in mm.: Snout to vent, 84; tail, 143; snout to arm-insertion, 30.6; axilla to groin, 46; head-width, 12.8; head-length, 20.6; wing-spread, 73; arm, 37; leg, 44.

Distribution: This species is rare in collections. In Thailand it has been taken once at "Bukit Besar," Pattani, at an altitude of 2500 ft. So far as I know the specimen from Khao Chong, Trang, is the second known from Thailand. It is doubtless confined to the provinces of southern Thailand.

Outside of Thailand it has been taken in the Larut Hills of Perak, Malaya, and in Borneo.

Remarks: Boulenger states that the tympanum of the type is nearly as large as the eye-opening; that there are ten or eleven supralabials, the dorsal head scales unequal, keeled, the leg reaching to axilla or between axilla and elbow of arm. The color is described as dark gray above, with a paler reddish ventral stripe; back and head above and beneath, with large black dots; wing membranes black above, throat and belly pale blue; inner side of neck-lappets and extremity of gular appendage lemon yellow.

A Bornean specimen was included with the type. Hennig, *loc. cit.*, however, restricts the type-locality to Larut Hills, Penang.

Draco quinquefasciatus Hardwicke and Gray

Two forms of this species are recognized. The type-locality of the typical form is Penang, Malaya. The other subspecies is Bornean. Only the former occurs in Thai territory.

Draco quinquefasciatus quinquefasciatus Hardwicke and Gray

FIG. 41

Draco quinquefasciatus Hardwicke and Gray, Zoological Journ., vol. 3, 1827, p. 219 (type-locality, Penang, Malaya); Gray, in Griffith's Cuvier's Animal Kingdom, vol. 9, Syn., 1831, p. 59; Günther, The reptiles of British India, 1864, p. 126; Flower, Proc. Zool. Soc. London, 1899, p. 637; Boulenger, Ann. Mag. Nat. Hist., ser. 6, vol. 8, 1891, p. 288; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 63 (Trang Thailand); de Rooij, The reptiles of the Indo-Australian Archipelago, vol. 1, 1915, pp. 81-82 (Sumatra, Borneo, Malacca, Penang); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June, 1916, p. 53; *ibid.*, vol. 2, no. 2, Dec. 1916, p. 154 (Tanjong Mas and "Bangnara" = [Narathiwat]); Bull. Raffles Mus., no. 3, 1930, p. 23.

Draco quinquefasciatus quinquefasciatus: Hennig, Temminckia, vol. 1, 1936, pp. 192-193.

Diagnosis: A large form, 105 mm., snout to vent; head relatively small; tympanum concealed, nostril directed upwards; a slight nuchal fold; no caudal crest; upper head scales small, subequal; dewlap narrow, reddish brown, dotted with darker; wings red, with five curved black bands of varying width, as broad as interspaces;

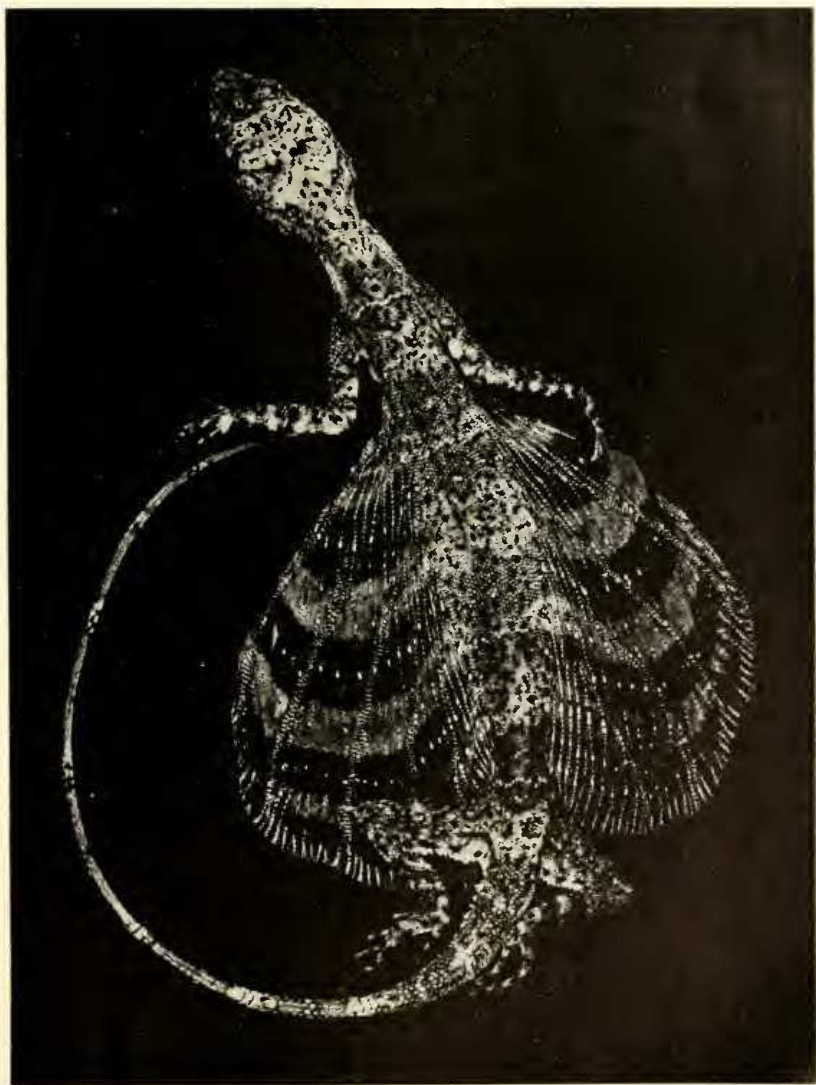


FIG. 41.—*Draco quinquefasciatus quinquefasciatus* Hardwicke and Gray. EHT-HMS No. M190 ♀. Ulu Langat Forest Reserve, Kajang, Selangor, Malaya. Actual length, snout to vent, 102; total length, 262 mm.

on underside of wings usually much narrower black bands; a black band across neck.

Description of species (from EHT-HMS No. M194). Head moderate in size, snout about length of orbit; rostral about two and a half times as wide as high, the upper edge denticulate, its surface rough with slight vertical striations; bordered laterally by two supralabials and posteriorly by nine postrostrals; nasal craterlike, nostril directed upwards and slightly backwards, separated from rostral by two scales, separated from its fellow by six scalerows; posterior canthals distinguishable, intermingled with anterior supraciliaries; supraciliaries bordered by tiny undifferentiated scales; tympanum completely concealed by small scales; 14-15 supralabials, last one very small, each with an indistinct keel and a ridge across lower side; mental triangular, with a labial border about equal to that of rostral; 15-16 infralabials, last very small, each with a longitudinal ridge at upper edge and a dim keel; mental bordered by a pair of chinshields the first of a series of six or seven larger scales; lappets on side of neck small; dewlap of female bearing a small, very slender terminal part; that of male much larger, reaching a length of 12 mm.; scales on snout irregularly conical, elevated, more or less keeled; a median series of slightly larger scales longitudinally keeled, scales not forming a Y-shaped pattern; scales above eyes, more flattened, keeled, imbricating; scales along supraciliary border small and lacking an enlarged scale on posterior part. An indistinct longitudinal row of larger scales runs back from middle of the posterior border of orbit toward tympanic area; scales above lappets enlarged, a few keeled; dorsal scales not or rarely keeled, sub-cycloid, strongly imbricate; a spaced row of enlarged more or less keeled scales at base of upper wing-membranes, white in color; scales on venter strongly keeled, as large or larger than dorsals, keels directed inwards; caudal scales strongly keeled; two rows of subcaudal scales forming two elevated ridges with a lateral ridge bordering them; no median caudal crest in female; paired scales on median dorsal surface of tail, without trace of a crest in males.

Arms moderate, the wrist fails to reach beyond snout; leg barely reaches elbow of adpressed arm; wing membrane ample, supported by six ribs; fringe of free scales along back of thigh moderate, reduced on tibia.

Color: Above reddish brown, dotted with darker on head, neck and dorsal surface of body; wings red above with five continuous

black bands of solid black color save for a series of small whitish dots covering slightly enlarged scales along their middle; intervening red bands about same width and curvature; black bands vary in width, second widest, last narrowest; these bands dimly indicated across the posterior part of the body; tail banded with gray and brown; below a series of broken transverse black bands directly below upper dark bands, reddish color appearing below; chin and part of throat bluish gray flecked with light and dark; dewlap distally grayish brown; a black band crosses neck in front of dewlap.

Measurements of *Draco quinquefasciatus quinquefasciatus*

NUMBER	193	191	189	192	190	194
Sex.....	♂	♂	♂	♀	♀	♀
Snout to vent.....	95	94	101	99	101	101
Tail.....	166	125+	164	162	162	162
Snout to arm.....	30	28	33	30	32	31
Axilla to groin.....	55	55	60	55	59	59
Width of head.....	13	12	13	13	13	13
Length of head.....	18.3	18.6	19	19	20	21
Arm.....	35	35	39	35	38	39
Leg.....	42	40	44	43	45	46

Variation: In some specimens the body is traversed by darker bands of a width equivalent to that of the transverse wing-stripes and occasionally the intervening areas are somewhat reddish.

In M190 there is little or no reddish brown. The front of the head is black; the latter half of the interorbital area and occiput are bluish gray variegated, and bordered by a narrow dark line. A broad light band with irregular edges crosses back of occiput, bordered by black behind. There are two transverse brownish spots which may be edged with minute white flecks. There are brown and fine white flecks scattered over head and dorsum. The basal parts of the wing-membranes are less red than the outer parts.

Distribution: The reason for including this species in the fauna of Thailand is the capture of specimens at "Tanjong Mas and Bangnara," localities in Narathiwat. I have seen one other specimen, taken in Yala, and Boulenger (1912) reports it in Trang.

In Malaya it is widespread. It also occurs in Borneo.

Remarks: All the specimens measured are from Selangor, Malaya. I have not found specimens in Thailand.

Draco melanopogon Boulenger

FIG. 42

Draco melanopogon Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 3, 1887, p. 492 (type-locality, Malacca, Malaya); Günther, Novitates Zoologicae II, 1895, p. 499; Lindholm, Jahrb. Nass. Ver., vol. 54, 1901, pt. 1, p. 307; Volz, Zool. Jahrb., Syst., vol. 19, 1903, p. 421; Boulenger, Fasciculae Malayenses, Anthropological and Zoological results of an expedition to Perak and the Siamese Malay States, 1901-1902, Zoology, pt. 1, 1903, p. 152; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 62; de Rooij, The reptiles of the Indo-Australian Archipelago, vol. 1, Sauria, 1915, p. 84; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916, p. 53 (Nakhon Si Thammarat); *ibid.*, vol. 2, no. 2, Dec. 1916, p. 154; Journ. Federated Malay States Mus., vol. 10, 1922, p. 268; Bull. Raffles Mus., no. 3, 1930, p. 25; Hennig, Temminckia, vol. 1, 1936, pp. 207-209, map no. 10; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1093-1095 (Phatthalung Province; Ban Chawang, Nakhon Si Thammarat).

Diagnosis: Wingspread about 75 mm.; snout-to-vent length about 85 mm.; dewlap much longer than head, terminating in a dull point, coal black except for a triangular posterior area near base which is ultramarine, gray, or pure white; wing-membranes black with very numerous small yellow or yellowish-brown spots; back variegated green and olive; no caudal or nuchal crest; nostrils directed upward; no inverted Y-shaped series, or other enlarged scales on snout or frontal area. Coloration of females similar to males.

Description of species (from No. 203, taken at the Hydroelectric Dam near Na Bon): Head very short, diameter of orbit a third or more greater than length of snout; rostral four times as wide as high, rectangular, bordered behind by ten postrostral scales and two labials; nasals craterlike, directed upward and slightly backwards; a slight median longitudinal elevation on snout; inner supra-ocular areas with somewhat larger scales than frontal areas; occipital region with still larger irregular scales; a blunt tubercular scale at back edge of orbit, no tubercle preceding it; tympanum distinct; supralabials, 15-15; infralabials, 14-13; mental small, nearly hemispherical, bordered by two labials and six small scales; no spiny tubercles above tympanum or on neck; five widely spaced enlarged scales at base of wing membranes above; no nuchal crest; no caudal crest; small fringe of scales on back of thigh and at base of tail; dewlap elongate, terminating in a blunt point; leg reaching axilla.

Color in life: Head, back, base of tail, and limbs yellowish green, variegated, with some evidence of darker markings across back; arms and legs indistinctly barred with darker; wing membranes

above black with numerous yellow or greenish-yellow spots; near base of wings a series of longitudinal greenish subparallel lines. Chin greenish bronze anteriorly, followed by magenta with minute black flecks; dewlap black, much longer than head, the color extending under inner anterior part of wattles; back part of dewlap ultramarine, connecting with an area of ultramarine under wattles;

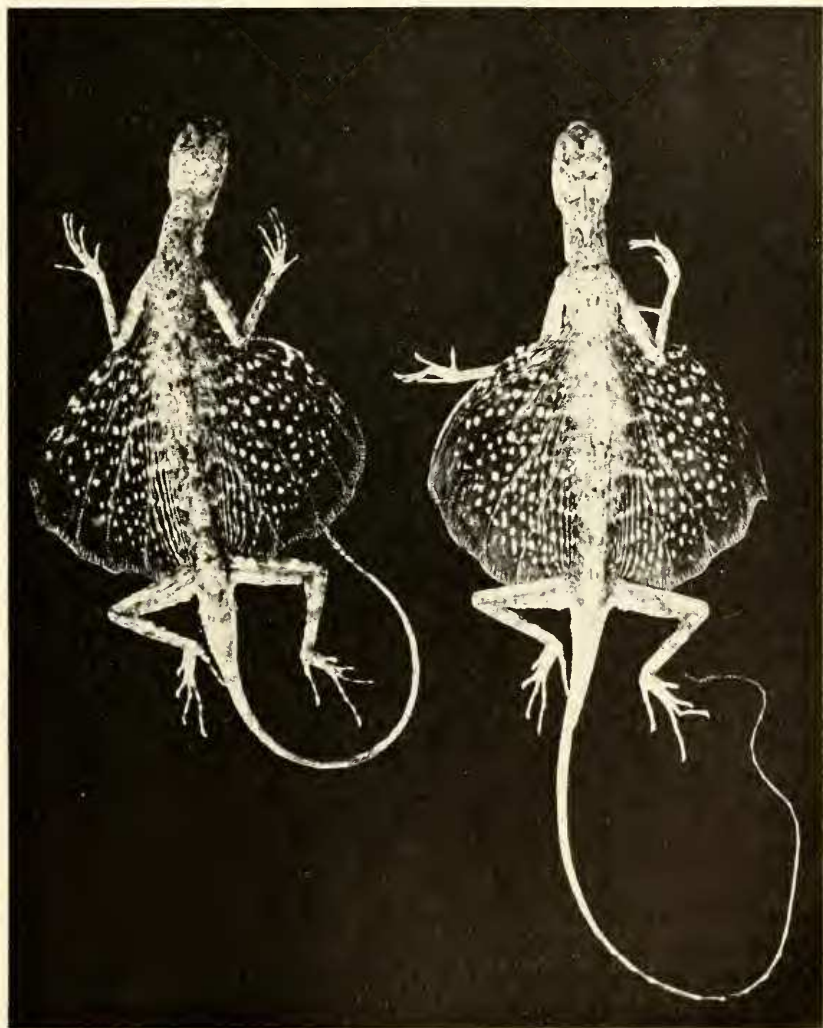


FIG. 42.—*Draco melanopogon* Boulenger. Left figure, No. 35743 ♂, Khao Chong (Mt.) Trang province, Thailand. Actual snout-vent length, 74 mm.; tail 144 mm. Right figure, No. 35625, Ronpibon, Nakhon Si Thammarat province, Thailand. Actual snout-vent length, 74 mm.; tail, 138 mm.

breast and venter dull yellow with reddish-brown flecks or spots; a thin greenish-yellow wash under wings, the black and yellow spots showing through; underside of arms and legs greenish yellow; tail banded with black and reddish brown, the brown becoming magenta on underside of tail. A bronzy area on back of head.

Measurements in mm. of *Draco melanopogon*

NUMBER*	200	203	204	205
Sex.....	♂	♂	♂	♂
Snout to vent.....	82	85	78	79
Tail.....	160	155	145	140
Snout to arm.....	24	24	24	24.5
Axilla to groin.....	46	43	42	44
Wingspread.....	77	75	74	71
Dewlap length.....	24	24	27	25.2
Head width.....	10.2	9.6	10.3	10.4
Head length.....	15	14	14	14
Arm.....	38	40	41	36
Leg.....	41	43	45	40

* Na Bon, Nakhon Si Thammarat

Variation: This species is strongly differentiated and is not apt to be mistaken for any other species. The males and females differ in the character of the dewlap, but in general coloration they are similar. The black on the dewlap is intense. The back part of dewlap, however, is somewhat variable; while always light, it may be gray, light ultramarine, or even pure white.

Distribution: In Thailand the species is seemingly found only south of the Isthmus of Kra. I have taken it in the provinces of Nakhon Si Thammarat, Yala, and Trang. It has been reported in Pattani and Phatthalung. It is not a rare species. The deep-black dewlap serves as a distinguishing mark that makes it easily identified in the forest.

Outside of Thailand the species occurs throughout Malaya. It is known also in Sumatra, Borneo, and the Natuna Islands.

Draco haematopogon haematopogon Boie, in Gray

Draco haematopogon Boie, in Gray, in Griffith's Cuvier's Animal Kingdom, vol. 9; Syn. 1831, p. 39 (no type-locality given; fixed by Willi Hennig, Temminckia, vol. 1, 1936, p. 204, as "Malay Peninsula"); Schlegel, Abbildungen neuer oder unvollständig bekannter Amphibien . . . 1837-1844, p. 95, pl. 24, fig. 6; Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 14, p. 61; de Rooij, The reptiles of the Indo-Australian Archipelago, vol. 1, 1915, pp. 84-86.

Draco (Pleuropterus) haematopogon: Fitzinger, *Systema reptilium*, 1843, p. 51.

Draco microlepis Boulenger, A vertebrate fauna of the Malay Peninsula
 Reptilia and Batrachia, 1912, p. 62 (*part*. Specimens from Larut Hills 3500
 ft. altitude); Robinson and Kloss, *Journ. Federated Malay States Mus.*, vol.
 5, no. 3, Oct. 1914, p. 154 ("Koh Pennan"); M. Smith, *Journ. Nat. Hist.*
Soc. Siam, vol. 2, Dec. 1916, p. 53 ("Koh Pennan"); *Bull. Raffles Mus.*, no.
 3, 1930, p. 23; de Rooij, *The reptiles of the Indo-Australian Archipelago*,
 vol. 1, 1915, pp. 84-86 (*part.*).

Draco haematopogon haematopogon: Hennig, *Temminckia*, vol. 1, 1931, pp.
 204-206, map 9; Mertens, *Treubia*, vol. 24, part 1, Dec. 15, 1957, pp. 90-91,
 101, 102.

Diagnosis: Nostril vertical; tympanum distinct not scaled; supra-
 labials keeled; dewlap large in males, and one and one-half to two
 times length of head, covered with small scales; smooth dorsal scales
 smaller than ventrals; no nuchal crest; wing with five ribs.

The fixing of the type-locality of *Draco haematopogon* as the
 Malay Peninsula by Hennig eliminates the possibility of calling the
 species *microlepis* as has been done by previous authors, including
 Boulenger who described *microlepis* from Merabah, North Borneo
 and regarded specimens from the Larut Hills, Perak, 3500 ft., as
 being the same form.

Description of species (from literature): Head rather small;
 snout shorter or barely equal to height of head; nostril directed
 vertically upwards; head scales small, keeled; tympanum naked;
 supralabials 9-13, distinctly keeled; dewlap of male one and one-
 half to twice length of head, in female about two thirds as long
 as head; dewlap covered with small scales; dorsal scales smooth
 not larger than those on venter; no nuchal or caudal crests; wing
 supported by five ribs. Leg about one and one-half times the axilla
 to groin distance.

Color: Above usually greenish or grayish, the upper side of wing
 brick-red to reddish with some black spotting, the lower surface
 greenish, or gray without spots. Undersurface of body greenish;
 throat red, dotted with brown and with large black spot on each
 side of dewlap which is yellow in male (rarely whitish).

Measurements in mm. (of female from Java): Snout to vent, 95;
 tail, 132; head length, 16.5; head width, 12; axilla to groin, 36;
 dewlap, 11 (male, 24); leg, 53.

Variation: The tail length of the above measured specimen seems
 very small compared to 181 mm. recorded by de Rooij (*loc. cit.*) for
 a specimen having a snout-vent measurement of 91.

Distribution: In Thailand the species is recorded from Koh Pen-
 nan (Koh Pha Ngan) an island off the eastern coast of peninsular

Thailand. In Malaya the species is reported in the Larut Hills, Perak. It has been taken also in Java, Sumatra, and Borneo.

Draco taeniopterus Günther

This species, one having practically the same distribution as *D. m. maculatus*, has two recognized subspecies, the typical one and *t. indochinensis*. Only the former is known to occur in Thailand.

Draco taeniopterus taeniopterus Günther

FIG. 43

Draco taeniopterus Günther, Proc. Zool. Soc. London, 1861, p. 187 (type-locality, Chartaboun = Chanthaburi, Chanthaburi, Thailand); The reptiles of British India, 1864, p. 126, pl. 13, fig. E; Blanford, Journ. Asiat. Soc. Bengal, 1878, p. 125; Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 269; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 113; Flower, Proc. Zool. Soc. London, 1899, p. 637; de Rooij, The reptiles of the Indo-Australian Archipelago, vol. 1, 1915, p. 85; M. Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 4, Dec. 1915, p. 239; M. Smith, *ibid.*, vol. 2, 1916, p. 53 ("southeastern Siam; Dong Rek Mountains eastern Siam; Muang Song Forest, Prae northern Siam"); Bull. Raffles Mus., no. 3, 1930, p. 22; The fauna of British India, including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 140-141.

Draco taeniopterus taeniopterus: Hennig, Temminckia, vol. 1, 1936, pp. 209-211, map no. 11.

Diagnosis: A small species, wingspread about 65 mm.; snout to vent, 76 mm.; nostrils directed upwards and backwards; distal part of dewlap rounded, covered with large translucent scales; olive to blackish-olive with a red to carmine area at base continuous with the carmine under wattles; wings olive, with four or five transverse dark bands; reddish or magenta on outer posterior part of wing; immaculate on underside, usually with a yellowish wash; two or three enlarged scales on snout in a line; more rarely an inverted Y-shaped scale-series on snout; no caudal crest. Little sexual dimorphism evident except in dewlap.

Description of species (from No. 457, Na Bon, Nakhon Si Thammarat): Head small, diameter of orbit greater than length of snout; rostral low, bordered behind by eight scales; nasals craterlike the nostril directed upwards and backwards, separated by five rows of scales; median longitudinal row of three enlarged scales on snout; four strongly keeled canthals; seven or eight supralabials; seven or eight infralabials; mental border on mouth shorter than rostral border; tympanum distinct; an enlarged rounded tubercle above tympanum, and a blunt tubercle back of orbital edge; scales on occiput enlarged, irregular in size, elevated; none or only a slight nuchal crest indicated; one or two enlarged scales in temporal

region; beginning on neck, a row of enlarged, widely-separated scales extends along basal part of wing-membranes, the enlarged scales often forming small groups; no caudal crest on mid-line; dew-lap rounding behind, distinctly longer than head, greater part of its surface covered with enlarged pointed scales.

Color in life: Above, head dark olive with a dark band indicated between front of orbits (or a black median spot); a black border

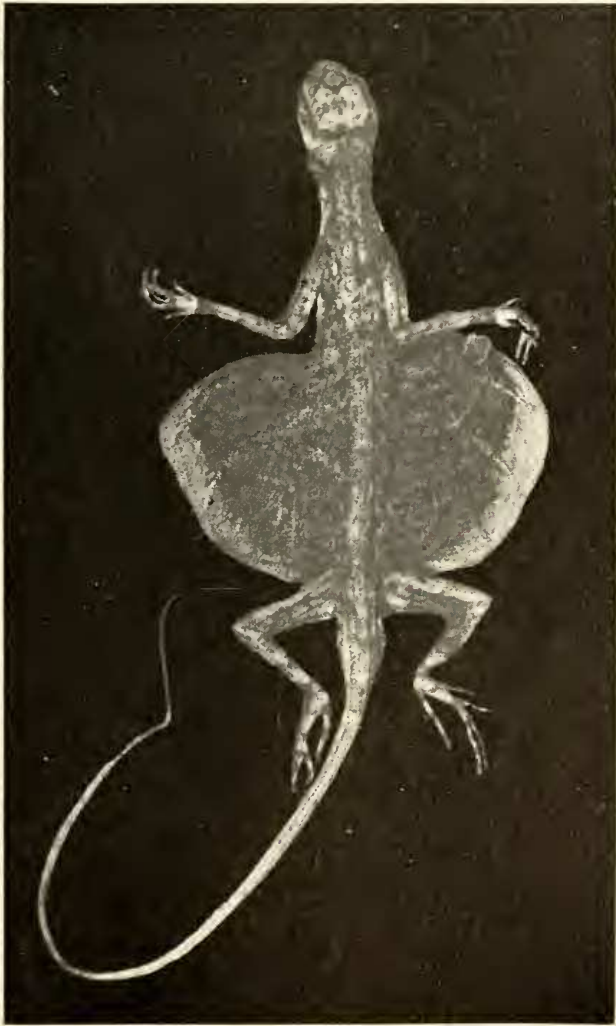


FIG. 43.—*Draco taeniopterus taeniopterus* Günther. No. 35864.
Forest Experiment Station, Trang province, Thailand.

behind occiput; some black punctate spots on neck; body bronzy or grayish olive with a brownish W-shaped shoulder mark and two similar indefinite marks on back; wing-membranes olive-yellow with broken tranverse black bands about as wide as interspaces, some of which tend to bifurcate near the body; outer posterior part of wing maroon to magenta; underside of wing yellowish, transverse marks showing through membrane; basal part of dewlap and underside of wattles orange-red to carmine; distal part of dewlap pale green or olive; venter and underside of limbs yellowish; limbs banded with dark olive.

Measurements in mm. of *Draco t. taeniopterus*

NUMBER*	457	462	460	461	399
Sex.....	♂	♂	♂	♂	♀
Snout to vent.....	75	74	71	66	77
Tail.....	152	125+	140	136	153
Snout to arm.....	26	26	24.3	23	26
Axilla to groin.....	41	39	37	35	43
Wingspread.....	64	68	58	61	64
Length of dewlap.....	21	20	19	19	1
Head width.....	10	10	9.8	8	11
Head length.....	14.6	15.2	14	13	16
Arm.....	34	33	33	31	36
Leg.....	42	43	42	37	38

* Na Bon, Nakhon Si Thammarat.

Variation: The enlarged scales on the snout occasionally are arranged in an inverted Y-shaped series, but are more frequently as described in this specimen, in the material available to me. There is but little variation in color pattern. The color of the back does vary and in life may change in a few minutes from one shade of green or olive to another.

The large specimen mentioned by Malcolm Smith (1935, p. 140) "100 mm. from snout to vent, tail, 180" belongs to another species. (See M. Smith, Bulletin Raffles Mus., no. 13, Aug. 1937, pp. 75-76, where the statement is corrected.)

Distribution: The species ranges in Thailand from near the Malayan border to the province of Chiang Mai in the northwestern part of the country; it occurs also in southeastern Thailand. Presumably it has not been taken in the eastern or northeastern parts.

Outside of Thailand the species occurs in southern Burma and the Mergui Archipelago, and doubtless extends into Cambodia.

Remarks: The female lays four eggs. These have a small shelf-like projection at each end, similar to those on the eggs of *D. blanfordii*.

Draco blanfordii Boulenger

FIG. 44

Draco major Blanford (*nec* Laurenti), Journ. Asiat. Soc. Bengal, 1878, vol. 47, 2, p. 125; *ibid.*, vol. 48, 1879, p. 128 (type locality, Forest east of Tavoy, Tenasserim, Burma).

Draco blanfordii Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 267, pl. 20 (new name for *Draco major* preoccupied); The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, p. 112; Fasciculi Malayenses, Zool. vol. 1, 1903, p. 153; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 61; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 3, 1915, p. 153; *ibid.*, vol. 2, no. 1, 1916, p. 53; *ibid.*, no. 2, 1916, p. 153; Bull. Raffles Mus., no. 3, 1930, p. 22; The fauna of British India, Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 141-142 (northwestern Thailand, Chiang Rai, southern Burma, Malaya); *ibid.*, no. 13, 1937, pp. 75, 76, pl. 8; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1091-1093.

Diagnosis: Large species, snout-to-vent length to 134 mm.; tympanum naked; nostrils directed upwards and outwards; head shields unequal, with or without an inverted Y-shaped series on snout; six scalerows between nasals; wing-membranes marbled with olive, usually with some five indistinct darker lines; a few brick-red flecks on upper membranes, posteriorly immaculate, yellowish below; red to salmon under wattles; gular appendage elongated, whitish, distinctly longer than head, with large transparent scales; throat nearly black; chin gray; median caudal scalerow elevated to form a low crest; a row of enlarged elevated keeled scales or groups of scales at base of wing-membranes.

Description of species (from No. 33680, Doi Suthep, Chiang Mai): Large species; rostral three-and-a-half times as wide as high, bordered behind by seven small scales, separated from nasals by one (or two) scales; nasals craterlike directed outward and somewhat upward, the length of one nasal about equal to distance between them; two median enlarged scales just back of level of nostrils, but no distinct inverted Y-shaped series discernible; canthal scales irregular but a series of elevated scales precedes canthus and continues above nasals; a slight constriction immediately posterior to nasals; supraorbital areas elevated; anterior supraciliary border with sharp-edged elongate scales; middle and posterior parts with small granular scales and with a rounded tubercle at posterior point; some enlarged scales on each side of occiput and one much enlarged keeled scale back of middle of eye, its posterior end reaching anterior level of tympanum; a few tubercular scales above and some-

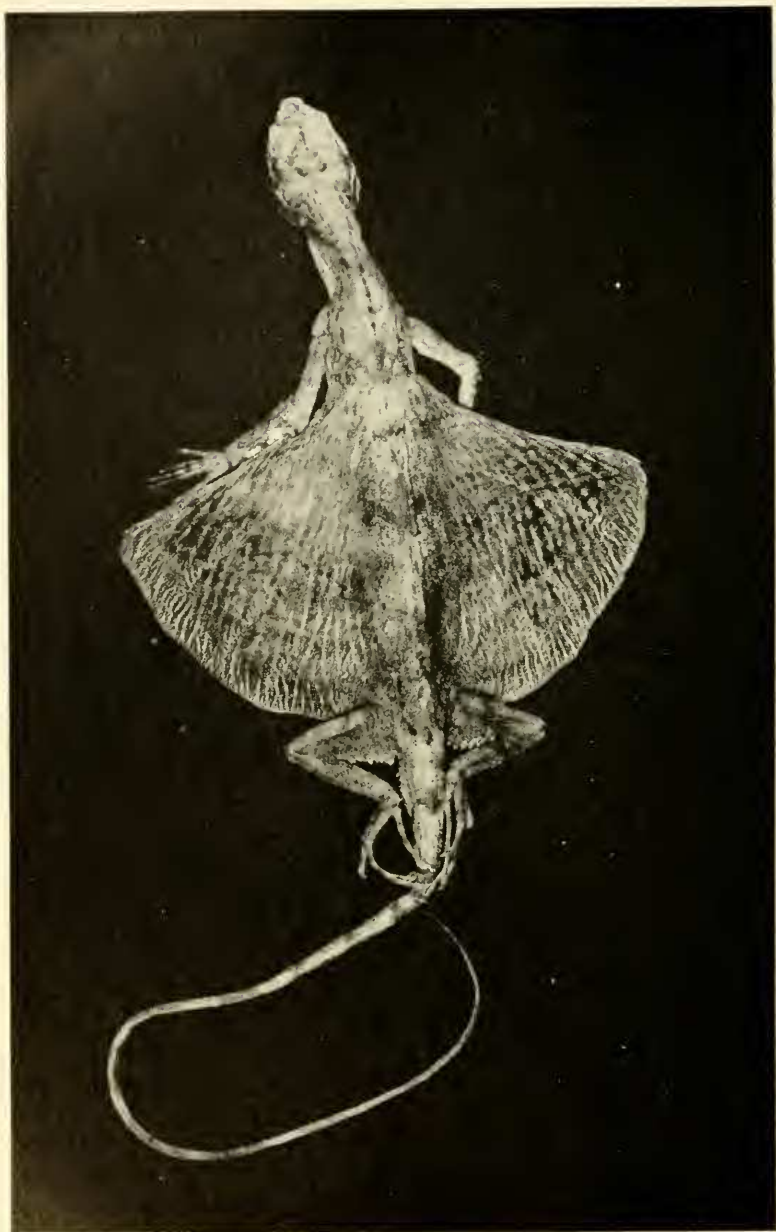


FIG. 44.—*Draco blanfordii* Boulenger. No. 469. Khao Chong Forest Experiment Station, Trang province. Actual snout-vent length, 102 mm.; total length, 280 mm.

what behind tympanum, one preceding it and one or two on cheek below it; nuchal wattles with several scales on upper surface distinctly larger than enlarged scales covering distal four fifths of the gular appendage; scales on dorsal part of body, small, somewhat unequal, distinctly smaller than ventrals, smooth or with a few scattered usually larger keeled scales; a spaced row of enlarged keeled elevated scales beginning on shoulder follow sides of the body to groin along base of wing-membrane; a very indistinct nuchal crest (in male); arm long, wrist reaching tip of snout; hind leg reaching or almost reaching axilla; fore- and upper-arm with enlarged keeled scales on upper surface; front of thigh and upper surface of tibia with enlarged keeled scales; one or two enlarged scales on posterior part of thigh; a fringe of enlarged free scales on back edge of thigh and on sides of base of tail; median scalerow on tail elevated to form a low crest for a fourth of its length.

Color: Above, on body, variegated grayish or grayish olive, mottled with lighter and darker; some indistinct blackish spots on neck and occiput; wing-membranes olive-gray mottled with darker olive and with some indefinite hair-fine darker lines; a few reddish or maroon flecks on outer posterior part of wing; under surface yellowish without black marks; venter as well as underside of leg and subcaudal region whitish; chin gray, growing nearly black on throat and around base of gular appendage; latter white, translucent; neck wattles red below; dark on front of shoulders. Tail banded with brown and gray; labials a little lighter than side of head.

Variation: The markings on the wings vary. Often the wings are practically unicolor, light or yellowish green with numerous longi-

Measurements of *Draco blanfordii*

NUMBER*	465	466	35704	194
Sex.....	♂	♂	♂	♀
Snout to vent.....	128	134	132	102
Tail.....	233	254	256	202
Head width.....	16	16	16	14
Head length.....	24	23	24	21
Snout to arm insertion.....	44	43.5	42.5	34
Axilla to groin.....	68	79	72	58
Greatest wingspread.....	125	124	122	114
Length of dewlap.....	37	31	36	8
Arm.....	52	51	53	44
Leg.....	58	60	64	56

* Na Bon, Nakhon Si Thammarat.

tudinal fine light lines formed of minute frosty flecks; other specimens may have a more or less distinct series of darker transverse bands across the wing, which may include a series of lighter areas. Several specimens have small blue-white spots covering the enlarged scales at the base of the wings and one specimen has a yellowish wash on the upper surface of the wing. Females lack the caudal crest, and have only a small dewlap.

My series consists of 13 specimens all but one of which is a male. The female has the typical coloration of "*cyanoaemus*" described from a female. Superficially in marking it resembles the pattern of *taeniopterus*.

Distribution: The species occurs in both northern and southern parts of eastern Thailand, specimens having been taken in Chiang Rai, Chiang Mai, Kanchanaburi, Phrae, Nakhon Si Thammarat, Phuket, Trang, Pattani, and Yala.

It is also known from Northern Malaya, and Burma as far north as the Dvana Hills. It has not been reported in the Indo-Australian Archipelago.

Remarks: Four eggs taken from the oviducts of the large female are oval, with the end "pinched" leaving a very narrow straight shelf on each end usually more pronounced on one end than other. The eggs measure approximately 14 x 7 mm. Whether eggs of most other species have this peculiarity I do not know. Once four eggs were dug up from the earth having this form but they could not be positively identified.

Draco formosus Boulenger

This form has three presumed subspecies, only the typical one occurring in Thailand.

Draco formosus formosus Boulenger

FIG. 45

Draco formosus Boulenger, Ann. & Mag. Nat. Hist., ser. 7, vol. 6, 1900, p. 190 (type-locality, Larut Hills, Perak, between 1500 and 3000 ft. altitude); Fasciculi Malayenses. Zoology, vol. 1, 1903, p. 152 (*part.*); Journ. Federated Malay States Mus., vol. 3, 1908, p. 65; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore, including the adjacent islands; Reptilia and Batrachia, 1912, pp. 61-62; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, Dec. 1916, pp. 153-154 ("Tanjong Mas and Bangnara," Pattani; Khao Wang Hiep, Nakhon Si Thammarat; Maprit, Pattani); *ibid.*, vol. 2, June 1916, p. 53 (peninsular and western Siam as far north as Lat. 14°30'); Journ. Federated Malay States Museum, vol. 10, 1922, p. 268 (Kuala Teku, Pahang, Malaya); Bull. Raffles Mus., Singapore, no. 13, Aug. 1937, pp. 75-76, fig. 2, pl. 8 (states that the female cotype is a specimen of *Draco blandfordi*).

Draco formosus formosus: Hennig, Temminckia, vol. 1, 1936, pp. 216-217, map no. 14.

Diagnosis: A large species (100 mm. snout to vent). Nostrils directed vertically upward; arm reaching somewhat beyond snout-tip; gular appendage of male with large blackish but translucent scales, not or slightly longer than head; tympanum naked. Wing-membrane with five more or less distinct cross-bands, outer part



FIG. 45.—*Draco formosus formosus* Boulenger. No. 35742, Khao Chong Forest Experiment Station, Trang province, Thailand. Actual length, 279 mm.

maroon; throat of both male and female and underside of lateral nuchal lappets, maroon or crimson (never green in female).

Description of species (from Bukit Besar, near Na Pradoo, Patani, No. 34430): Rostral quadrangular nearly four times as wide as high, bordered laterally by two labials and eight small postrostrals; nasals large, craterlike, separated from rostral by one scale, from each other by five or six scalerows; nostril directed vertically upward; head scales unequal; a median longitudinal row of four keeled scales beginning between nasals terminates in middle of forehead; canthal scales enlarged, separated from nasals by three small scales; one enlarged keeled scale lies on snout touching canthals, the keel directed outward and backward; one or two enlarged supraocular scales on anterior edge of orbit; supraorbital areas elevated, the inner scales somewhat enlarged; a low rounded tuberculate scale at back corner of orbit; a very indistinct nuchal crest in male, absent in female; tympanum naked; an enlarged scale about midway between tympanum and nuchal crest; 10-9 supralabials each with a weak irregular keel evident near upper border and an indistinct keel on lower edge; above labials a slight shelf continued back under eye; ten infralabials with an upper and a lower ridge or keel on each; mental wider than long; scales subequal, smooth on body, with small groups of enlarged keeled scales along base of wings; ventral scales larger than dorsals, strongly keeled, keels directed inwards and backwards; gular appendage of male slightly longer than head, distal portion widened and covered with large quadrangular scales, somewhat translucent; small wattles on side of neck with large scales on outer upper surface; medium scalerow on tail forming a slight crest.

Arm extending length of second finger beyond tip of snout; leg reaches half way between axilla and elbow. A fringe of enlarged scales on edge of tail base and along back edge of thigh; scales on front of thigh and tibia enlarged.

Color in life: Above gray-olive with bluish and greenish flecks and occasional cream-colored scales; a black interorbital spot; two black spots on occiput and two on neck; back with a few indefinite dark markings continuous with dim darker lines crossing wings transversely; arms indefinitely banded; legs with some indefinite darker areas; toes banded in brown and gray; wing-membranes generally olive-gray above, the distal part maroon; under chin a dim gray reticulation; wattles dull pinkish above, while a large spot of

maroon covers underside of wattles and posterior part of gular appendage; most of gular appendage smoky-gray, the edges of enlarged scales whitish; breast, underside of limbs, venter, underside of thighs, and base of tail, white. Underside of wings grayish with an indefinite yellowish wash; distal part maroon as on dorsal surface; tail with broad bands of brown and gray.

Measurements in mm. of *Draco formosus formosus*

NUMBER	34430	35742	34851
Sex.....	♂	♂	♀
Snout to vent.....	99	101	89
Tail.....	146	170	163
Head width.....	12.5	13.2	12
Head length.....	19	19	17
Gular appendage.....	22	25	9
Arm.....	42	42	38
Leg.....	52	49	42
Greatest width of wing.....	42	42	37

No. 34430, Na Pradoo, Pattani; 35742, Khao Chong Trang; 34851, Bhetong, Yala.

Variation: The female specimen shows no trace of the nuchal crest but the color is practically identical with that of the male. Malcolm Smith (1937) has pointed out, that the female cotype of *D. formosus* is actually a *Draco blanfordii*.

The dark transverse irregular bands on the wings vary. In a female there are five, all enclosing lighter spots. The first (anterior-most) is very short, the second and third widest, the fourth longest, the fifth consisting of a few black flecks or small spots. The bars on the arms are very strongly defined, each bar having a lighter median part; those on the legs are similar but more indefinite.

The head-markings of the female include the interorbital spot, two small occipital spots (close together) and a pair of tiny spots on the neck; there are two dim transverse light bands across the head behind and in front of the black interorbital spot.

The scales in the fringe on the back of the thigh are largely cream in color. The tiny gular appendage is cream-white flanked on each side by pinkish or light maroon; underside of lateral nuchal wattles at least partly pink; yellowish brown (variegated) above.

Remarks: Specimens were found on forest trees usually at considerable distances from the ground.

Distribution: The species occurs in southern Thailand. It has been reported from Trang, Narathiwat,* Nakhon Si Thammarat and Chumphon.

It is known also in Malaya where it reaches from sea-level to 3500 feet altitude. Specimens formerly reported from Borneo and Sumatra are now regarded as belonging to *D. f. obscurus*.

Genus ACANTHOSAURA Gray

Acanthosaura Gray, in Griffith's Cuvier's Animal Kingdom, vol. 19, 1831, Suppl., p. 5 (type of genus, *armata*.)

Goniocephalus M. Smith, The fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 157 (*part.*)

Diagnosis: Body somewhat compressed, usually with a rather sharp dorsal ridge and a dorsal crest larger in males; dorsal scales unequal, heterogeneous; a gular pouch may be present; a fold across shoulder usually conspicuous. Tympanum naked or partially covered by scales; tail somewhat flattened, the scales keeled and larger than dorsal body scales, longer than broad. No femoral or preanal pores.

In 1916 Malcolm Smith recognized four species in Thailand—*Acanthosaura armata* (with which was united *A. crucigera* Boulenger), *A. horrescens* Gyldenstolpe, *A. capra* Günther and *A. coronata* Günther.

In 1943 his opinions having changed, he united the genus *Acanthosaurus* with *Goniocephalus* and recognized three forms—*G. armatus crucigerus*, *G. armatus armatus* and *G. lepidogaster*. I am uncertain what specimen he has identified as *capra* for in this later work he mentions only four specimens of this species, none from Thailand. *Coronata* has been identified with Cuvier's *lepidogaster* after his having examined the types of Cuvier's species in Paris.

Three forms are known to occur in Thailand, a fourth should be searched for in the mountains of central northern Thailand. All known Thai forms have a postsupraciliary—and a lateral nuchal spine.

KEY TO SPECIES OF ACANTHOSAURA IN THAILAND

1. No diamond-shaped black mark on neck and shoulders; no Y-shaped series of scales on snout; tympanum large, naked; dorsal and nuchal crests separated by a small diastema 2 to 3 mm. in length; tail base swollen in males; a small nuchal pouch *armata*
- A diamond-shaped black mark on dorsum of neck 2

* M. Smith's localities "Tangong Mas and Bangnara" Pattani, are now actually in the province of Narathiwat.

2. Spines of nuchal and dorsal crests separated by a diastema of seven to eight millimeters, the intervening space covered with small equal scales similar to upper body scales; nuchal black spot with "arms" reaching down on side connecting with diagonal black spot on shoulder. Head slenderer than in *armata*. Spine at supraciliary border and nuchal spine often as long as the diameter of orbit, *crucigera*

Spines of the nuchal and dorsal crests very close together but there is actually a separation since the spines at end of nuchal and beginning of dorsal crest may be shorter; postorbital and nuchal spines not half as long as orbit; no gular pouch; nuchal spot not connecting with diagonal mark on shoulder; spine on head less than half diameter of orbit *lepidogaster*

Acanthosaura lepidogaster (Cuvier)

FIG. 46

- Calotes lepidogaster* Cuvier, Règne Animal, 2nd Ed., vol. 2, 1829, p. 39 (type-locality, Cochinchina).
Lophyrus tropidogaster Duméril and Bibron, Erpétologie générale, vol. 4, 1837, p. 413 (emendation for *lepidogaster*).
Acanthosaura coronata Günther, Proc. Zool. Soc. London, 1861, p. 187 (type-locality, Cambodia); The Reptiles of British India, 1864, p. 149, pl. 14, fig. E.
Acanthosaura lamnidentata Boulenger, Catalogue of the Lizards in the British Museum, vol. 1, 1885, p. 302, pl. 22, fig. 3 (type-locality Pegu, Tenasserim); The fauna of British India . . . Reptilia and Batrachia 1890, p. 126.
Acanthosaura hainanensis Boulenger, Proc. Zool. Soc. London, 1899, p. 957, pl. 66, fig. 2 (type-locality, Five Finger Mountains, Hainan).
Acanthosaura braueri Vogt, Sitz. Gesells. Nat. Fr. Berlin, 1914, p. 97 (type-locality, "S. China").
Goniocephalus lepidogaster: M. Smith, The Fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 161-162 ("N. Siam").

Diagnosis: A compressed median dorsal ridge on back surmounted by a low serrate dorsal crest; small spine behind end of supraciliary edge and a small nuchal spine somewhat above tympanum. A row of three or four scales from above tympanum extending towards eye, anterior end of the series not lower than upper level of tympanum; a nuchal crest of compressed scales, broad at their bases, separated from low dorsal crest by a narrow diastema; outer part of tympanum with small scales but never covering entire surface; a Y-shaped series of enlarged scales, usually if not always present on snout.

Description of species (from No. 35901, Doi Suthep, Chiang Mai): Rostral three times as wide as high bordered by two labials and five postrostral scales; nasal large separated from rostral by

two scales; a row of enlarged keeled scales on snout with two posterior branches forming an inverted Y-shaped figure; dorsal head scales unequal most of which are keeled, some rugose; canthal and supraciliary edge sharp, projecting outwards; a short spine behind supraciliary edge much less than half diameter of orbit;



FIG. 46.—*Acanthosaura lepidogaster* Cuvier. No. 1639 Doi Suthep, about 960 m. Chiang Mai province. Actual total length, 176 mm.

tympanum partly scaled over; row of three or four keeled scales from above tympanum to orbit, last much lower than upper level of tympanum; on back edge of occiput a transverse group of spines, one larger than others, directed upwards and backwards; strong nuchal crest of six to eight lanceolate spines their bases overlapping, the first two and last smallest; crest bordered by one row of enlarged, keeled and somewhat mucronate, erect scales; eleven or twelve supralabials, and a similar number of infralabials; mental small, separating first pair of postmentals which begin series of ten or twelve enlarged keeled scales; scales of chin angular, keeled, directed mesially, smaller than strongly keeled ventral scales; upper part of body with a compressed ridge, surmounted by a low dentate dorsal crest, separated from nuchal crest, terminating at base of tail; dorsal and lateral scales very small, intermixed with large keeled scales single or in small groups, sometimes in indefinite lines; scales point backward and upwards; small scales not smooth, some more or less keeled. Tail compressed, a half longer than head and body, all scales keeled strongly, the median subcaudal rows enlarged; a small diagonal skinfold from shoulder to near middle of neck; a slight gular pouch. Scales on arm keeled, mostly enlarged; third and fourth fingers subequal, with 17 scales below each, the scales doubly keeled with small spines or mucrones; fourth toe much the longest with 22 scales on its underside, most with a single keel. Leg reaches eye.

Color in life: Above, head dark black-brown, becoming more olive in occipital region. Side of head and orbital region with a blackish spot continued around back of occiput to a large black median spot which widens on shoulders; this spot bordered below by a clay-white line not quite meeting its fellow on median dorsal line; side of neck, tympanic area, and back part of labial area greenish yellow. Throat lively rose, the anterior labial and loreal regions pinkish white; venter yellowish with a greenish tinge. Underside of limbs and subcaudal area whitish; dorsum and limbs grayish brown with paired lateral black spots becoming brownish and fused on tail, forming large brown spots that are separated by light-gray bands; distal dark bands surround the tail. A very distinct dark-edged cream-spot on elbow, one on back of thigh and one across tibia; the two latter are contiguous when limb is folded.

Variation: The Y-shaped series of scales on snout and frontal area is more or less distinct in all specimens examined. The sharp com-

Measurements in mm. of *Acanthosaura lepidogaster*

NUMBER	36901 ♂	35902 ♂	33966 ♀	69 ♀
Snout to vent	76	72	85	91
Tail	118	104	104*	110
Total	194	176	189	201
Snout to arm insertion	28	28	37	31
Axilla to groin	38	35	42.5	46
Head width	16.3	16.4	20.3	21.2
Head length	22.6	21	27	28.5
Arm	41	39	45	46
Leg	67	59	65	70

* Incomplete; (all specimens from Doi Suthep).

pressed dorsal ridge is strongly evident. In the males available to me there is not much difference in height in either the nuchal or the dorsal crests, or between the two sexes.

Distribution: Chiang Mai, northern Thailand.

Remarks: When these specimens were found during a rain, they usually were dull brownish black, practically no trace of pattern being discernible. After a night in captivity the specimens displayed a maximum of bright color, the males always more colorful than females.

Several of the females contain eggs. No. 33966 has eleven, measuring approximately 7.5 x 10 mm. The stomach contents of this specimen consists chiefly of the remains of hymenopterous larvae. Wings identified as those of termites were also discerned.

Acanthosaura armata (Gray)

FIG. 47

Agama armata Gray, Zool. Journ., vol. 3, 1827, p. 216 (type-locality, Singapore.)

Acanthosaura armata: Gray, Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 240; Griffith's, Cuvier's The Animal Kingdom, vol. 9; Syn. 1831, p. 5, 1864, p. 148 (*part.*); Günther, Reptiles of British India, 1864, p. 148; Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 301, pl. 22, fig. 1 (side view of head and body); The fauna of British India, Ceylon and Burma; Reptilia and Batrachia, 1890, p. 125 (*part.*); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 154, (*part.*).

Lophyrus armatus: Duméril and Bibron, Erpétologie générale . . . vol. 4, 1837, pp. 413-416.

Gonyocephalus (Acanthosaurus) armatus: Fitzinger, Systema reptilium, 1843, p. 44.

Gonyocephalus armatus armatus: M. Smith, The fauna of British India, Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 158-160, fig. 49; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, p. 1095.



FIG. 47.—*Acanthosaura armata* Gray. No. 2640 ♂. Na Pradoo, Pattani, Thailand. Actual snout to vent length, 118 mm.; tail, 166 mm.

Diagnosis: A spine behind orbit and one on side of neck, these nearly or quite as long as orbit; gular pouch absent; base of tails in males strongly swollen; supraciliary edge broadly overhanging eye; no Y-shaped series of scales on snout and frontal area; tympanum large, naked, somewhat smaller than eye-opening; no diamond-shaped black area on neck and shoulders; high nuchal and dorsal crest separate (one or two mm.); scales on sides minute with small intermixed tubercular scales.

Description of species (from No. 2640 ♂ Na Pradoo, Pattani): Head triangular in lateral or dorsal profile; interorbital and frontal areas sloping almost straight down to snout-tip, directed forward. Rostral small, bordered by a labial on each side, and posteriorly by five scales; nasal scales large, craterlike, the nostril directed outward and slightly backwards, separated from rostral by two scale-rows. Head above covered by numerous scales of irregular size and shape, largest ones above orbital areas with three somewhat enlarged ones on median part of snout, but no Y-shaped arrangement; most scales keeled, the keels directed forward; interocular scales smaller, keels low, directed outward; a slight transverse ridge across occiput; scales a trifle larger than adjoining scales; a row of twelve enlarged scales begins at nostril and borders canthus and supraciliary edge to back of orbit, strongly projecting, the scales exposing a broad undersurface; a second row of larger scales border these above; a row of infraocular scales runs back and upwards and continues back to above tympanum, the series consisting of 18 scales, posterior largest. Between seventh supralabial and sixth canthal about 15 scalerows; mental small, its labial border smaller than rostral, enclosed behind by a pair of chinshields which are the beginning of an enlarged series of 15-17 scales, separated from labials by two rows of small scales, most of them with strong keels; a slight gular pouch evident (old male). A pair of erect elongated spines at back edge of orbit, touching last supraciliary, but separated from it at base; spine surrounded by two or three circular rows of pointed scales directed upwards; scales on back of occiput rather uniform but with small erect keels or spines. A pair of erect spines directed somewhat outward above tympanum on sides of neck, surrounded by a row of four elongate erect scales and a circular lower series of about twelve scales; nuchal crest begins a little in advance of these spines terminating in front of shoulders, consisting of ten compressed spines, first two shortest, and flanking these a similar number of erect scales alternating but

shorter, and one or two other similar rows of shorter scales. Dorsal crest similarly developed but near middle of back it reduces to a very low crest and continues as a row of keeled submucronate scales to tail; scales on sides of neck and body small, erect, subimbricate, keeled, or spinelike, points directed upwards in upper part of body, gradually directed backwards lower on sides; scattered enlarged keeled scales on sides and back, the small scales being 20-22 per centimeter; scales on chin larger than body scales, keels directed backward; scales on venter much larger than dorsals (eight to a centimeter) very strongly keeled, the keels directed backwards and on sides of venter slightly outwards; in preanal area about ten transverse scalarows three of which are larger than others; base of tail much swollen; subcaudal scales enlarged, elongate, sharply keeled and mucronate; scales on front surface of upper and lower arm rather large; leg similarly scaled; eye opening diagonal (8 mm.); tympanum naked, its greatest diameter 5 mm.; length of forward directed postorbital spine, 7.2 mm.; hemipenes extruded, each showing two primary lobes one centimeter long, strongly honeycombed with rather deep pits, and each lobe again divided distally into two short lobes; arm pressed forward, wrist reaches tip of snout; leg adpressed, fourth toe reaches halfway between tympanum and eye.

Color: This specimen is nearly uniform brownish fawn the head a little more brownish with only very indefinite traces of a dorsal reticulation; a dim diagonal black line in front of shoulder overhung by a diagonal skinfold. Tail gray-brown with narrow light bands above; chin and throat with very dim longitudinal darker lines; venter and much of subcaudal region white; limbs grayish brown, banded dimly.

Measurements in mm. (of Nos. 2640 ♂ and 2641 ♀): Snout to vent, 118, 108; tail, 166, 139; snout to arm-insertion, 43, 35; axilla to groin, 58, 54; height of head, 24, 22; length of head, 33, 30; width of head, 23.5, 21.5; arm, 68, 58; leg, 88, 80.

Variation: A female specimen, No. 2641, from the same locality (Na Pradoo, Pattani), has a reticulate gray-brown pattern enclosing somewhat elongate lighter fawn areas; the chin and throat has a median whitish stripe bordered by two longitudinal black stripes with two or three other parallel dark lines less distinct; head darker brown with some dark lines radiating from about eye; a dark diagonal line in front of shoulder partly hidden by a skinfold in the area; venter and under limb whitish, two light spots on pos-

terior upper surface of leg; digits with bars of brown and fawn. The crests are lower.

Distribution: This form described from Singapore is found throughout Malaya and probably reaches no further north than the Nakhon Si Thammarat Mountains in the province of that name. It has been reported in Sumatra, Tenasserim and Cochin China. I cannot vouch for these three reports.

Remarks: This species was found on Bukit Besar at or near Na Pradoo. It occurs with another species which is here identified as *crucigera*. Since the two forms exist together and each maintains its own structural characteristics they cannot be regarded as members of the same species. The second form has the scales more imbricating, the ventral scales large (7 to a centimeter) head strongly banded, venter brown spotted, throat and chin black, and much lower spines and crests. In the form described the minute hairlike spines on each scale are conspicuous under a lens.

Acanthosaura crucigera Boulenger

FIG. 48

Acanthosaura armata (part.) Blanford, Journ. Asiat. Soc. Bengal, vol. 48, 1879, p. 130.

Acanthosaura crucigera Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 302 (type-locality Tavoy, Burma); The fauna of British India, Ceylon and Burma; Reptilia and Batrachia, 1890, p. 125; A vertebrate fauna of the Malay peninsula . . . Reptilia and Batrachia, 1912, p. 69; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, p. 154, 1915 (part.); *ibid.*, vol. 2, June 1916, p. 53 (part.); (unites *crucigera* and *armata*); The fauna of British India, Ceylon, and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 160-161 ("Peninsular Siam, Patani, Isthmus of Kra, Tenasserim and the adjacent hills of Siam; hills north of Pre and Dong Paya Fai Mountains in N. Siam; S. E. Siam (Chantabun [= Chanthaburi]); [island of] Koh Chang and the adjacent territory in Cambodia."

Diagnosis: Spines of nuchal and dorsal crests usually broader at base than in *armata*, and the two crests separated by a greater distance (seven to eight mm.), the intervening space covered with small equal scales, similar to those on sides of neck; a black nuchal spot, narrowed much on either end, and connecting with the black diagonal band on front of shoulder, roughly cruciform in shape although considerably widened on shoulders; body and head slenderer than in *armata*; scales under tail forming transverse rows curving forward somewhat, the scales longer than wide; tympanum naked, distinctly smaller than eye-opening; a spine present at back edge of orbit, and one on side of neck their height much less in each case than half diameter of orbit; crests low, especially dorsal, situated on a sharp median elevated ridge; crest scales widening on

base of tail, and terminating behind level of vent. Leg, pressed forward, reaches near to nostril; no Y-shaped series of scales on snout and frontal area.

Description of species (from No. 192 Na Bon, Nakhon Si Thammarat): Body compressed forming a relatively high median ridge, surmounted by a dorsal crest; body triangular in cross-section. Head



FIG. 48.—*Acanthosaura crucigera* (Boulenger). No. 192, Na Bon (hydroelectric dam) Nakhon Si Thammarat, Thailand. Actual length, snout-vent, 103 mm.; tail, 146 mm.

generally triangular seen in lateral profile; rostral wider than high, bordered laterally by a labial and posteriorly by five scales; scales on snout larger than those in *armatus* (12 between fifth canthals; 16 or 17 in *armatus*); eight scales between nasals (12 in *armatus*); median row on snout a little larger and more strongly keeled than other; scales on snout smooth or with keels, the keels variously directed; some scales near tip of snout equally as large or larger than scales in supraorbital region, most of which are keeled, the keels directed forward; nasals large, craterlike, separated from rostral by one scale; nostrils directed outward; a series of 13 canthal-supraciliary scales overlapping somewhat and overhanging eye the edge not serrate; an elongate erect conical spine at back edge of orbit, surrounded by six pointed scales and an outer circular row of about ten erect smaller scales; a low transverse occipital ridge behind which scales are unequal, rather large, and conical; an erect spine on each side of neck surrounded by four erect keeled compressed scales; a suborbital scale series not continuous with enlarged scale series running from orbit diagonally backwards and terminating above tympanum, consisting of six thickened keeled scales; tympanum naked; supralabials, 12-12, row bordering supralabial above not enlarged; 11 scales between fifth labial and fifth canthal; infralabials, 11-11; mental about one third as large as rostral, bordered behind by two scales, each the first of series of seven enlarged sublabials, separated from infralabials by one row of scales posteriorly; scales on chin and throat somewhat erect, keeled, and usually mucronate.

Nuchal crest consisting of seven erect spiny scales flanked laterally by three rows of smaller erect scales; an interval of seven millimeters between this crest and dorsal crest; latter consisting of low scales strongly compressed, widened at base, the erect tips pointing upward and somewhat backwards; on rump these scales become somewhat flatter and wider, the series continuing for a short distance on tail; this crest flanked by one or two compressed erect rows of scales much lower than those of crest. Scales on sides of neck and body imbricate, subequal, angular, the angles pointing upwards and backwards, with large flat scattered keeled scales intercalated. Scales lower on sides and on posterior part of sides point nearly directly backwards. Tail of female not widened, rather triangular in cross-section at base; subcaudal scales forming curving transverse rows, scales longer than wide; four short rows of enlarged scales in preanal region; ventral scales large, strongly keeled, in regular longitudinal and diagonal rows, the keels forming lines directed

somewhat outwards; scales larger than in *armatus* (six in a centimeter); scales on upper surface of arm with enlarged keeled scales; scales on femora large, rather regular in front; on upper and posterior sides scales irregular, some much enlarged; scales large, more regular, on tibia; 22 keeled thickened lamellae under fourth toe; third and fourth fingers equal; a skin-fold in front of shoulder. Tympanum moderate (4.8 mm.); length of eye-opening, 5.5 mm.; height of postorbital spine, 5 mm.; height of highest nuchal spine, 4.8 mm.; highest spine in dorsal crest, 2.8 mm.; arm brought forward the wrist reaches one-half centimeter beyond snout; leg adpressed, the toe reaches middle of eye. Each ovary with five eggs.

Color in life: Front of head with transverse bars of black and green, the most prominent green one crossing orbital region; third black bar forms a median angle; lips yellow with a series of black spots, parts of radiating lines from eye; eye black; body with a deep black reticulum enclosing yellowish to brownish yellow spots; spots larger posteriorly; a whitish or whitish-yellow ocellated spot at knee and elbow, with certain others indicated on arm and leg; venter creamy with some metallic green reflections and with black spots or vermiculations; an elongate black nuchal spot widening on shoulder and fusing with a dark diagonal line in front of shoulder; chin and throat blackish with a suggestion of a nuchal pouch; arms with darker and lighter marks above; legs darker above with suggestions of brown bars below. Tail banded with dark-brown and dirty light-brown.

Measurements in mm. (Nos. 192 ♀, 3887 ♂, and 3885 ♀): Snout to vent, 103, 95, 97; tail, 146, 81 *, 135; snout to arm-insertion, 35, 38, 32; axilla to groin, 52, 49, 46; length of head, 29, 25, 25; width of head, 20.8, 18, 19.5; height of head, 16, 15, 15.2; arm, 54, 56, 54; leg, 83, 88, 75.

Variation: The two specimens (Nos. 3885 ♀, 3887 ♂) from Na Pradoo, Pattani, were taken at "rather low elevations" on Bukit Besar. The body of the female contains ten large eggs (one centimeter in diameter). The width of the distended body is 35 mm. The area on the side of neck below the nuchal spot is cream, the color extending onto labials. The lateral reticulum is less distinct and there is a series of somewhat indefinite large brownish spots on the upper part of body. The spotting on venter is reduced. The male (No. 3887) strongly resembles the male from Na Bon, Nakhon Si Thammarat, some 200 km. north.

* Incomplete.

One young specimen from Na Pradoo, No. 3886, resembles the female No. 3885. The venter has a distinct reticulum. There is a dark line on the supralabials and one bordering the infralabials.

Distribution: In Thailand the species occurs in the peninsular provinces. Outside of Thailand it occurs in Burma, the type-locality being Tavoy.

Remarks: The intestines especially the colon of three specimens examined, were packed with feces containing very few identifiable insect remains, but seemingly much earth and sandgrains. One suspects that this may be engulfed with earthworms. The species is terrestrial.

Genus GONIOCEPHALUS Kaup

Gonocephalus Kaup, Isis, 1825, p. 590 (corrected to *Goniocephalus*), 1827, pp. 610-614 (type *tigrinus* = *chamaeleontinus*).

Gonyocephalus: Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 282.

Diagnosis: Body strongly compressed; a gular pouch usually evident at least in males; dorsal scales unequal in size and shape; a dorsal crest; tympanum naked, superficial. A fold in front of shoulder extending onto throat; tail compressed; no preanal or femoral pores.

Three species are present in the fauna of Thailand. All confined to the southern part of the country. These are *Goniocephalus grandis*, *G. abbotti*, and *G. borneensis*. Although, in a previous paper (Taylor and Elbel, 1958) I followed Malcolm Smith in regarding *Acanthosaura* a synonym of *Goniocephalus*, more careful study of the forms, especially in the field, leads me to believe that this is not the true relationship. In this work I am regarding *Acanthosaura* a separate genus.

KEY TO THE SPECIES OF GONIOCEPHALUS IN THAILAND

1. Supraciliary border strongly elevated; dorsal crest almost as high as nuchal crest; a row of five enlarged scales on the sides *abbotti*
- Supraciliary border not strongly elevated 2
2. Enlarged scales scattered over sides; nuchal and dorsal crests continuous, very high in the male; dorsal, gular, and ventral scales strongly keeled *borneensis*
- No enlarged scales on sides; nuchal crest very high in males, composed of long spines united together and free only at tips; a notch between nuchal and dorsal crests; gular and ventral scales smooth, *grandis*

These animals are usually to be found in high trees. The young of *grandis* may be terrestrial and somewhat aquatic. A group of

young that I believed to be the young of *grandis* were seen on the tip of a small peninsula at Songkhla in shrubs growing in a pool. When disturbed these lizards would take to the water and swim under water to another clump of shrubs also in the same pool. None were captured since they were discovered when I was on the point of leaving the city. If they were not the young of *grandis* they were certainly no known species occurring in Thailand.

Malcolm Smith has placed *Goniocephalus abbotti* as a synonym of the Bornean form *G. doriae*. The differences that obtain would seem to preclude this association.

Goniocephalus abbotti Cochran

Goniocephalus abbotti Cochran, Proc. U. S. Nat. Mus., vol. 60, 1922, pp. 1-3 (type-locality, Trang, Thailand).

Goniocephalus doriae: M. Smith, Bull. Raffles Mus., no. 3, 1930, pp. 24-25 part. ("Benang Star," Yala, Thailand).

Diagnosis: Large species with canthus rostralis strongly projecting, and supraciliary border strongly raised, forming a sharp posterior angle; a series of much-enlarged dorsolateral scales. Nuchal and dorsal crests continuous, the crest distinguishable far onto tail. Body and tail strongly compressed; tail with eight dark bands separated by lighter bands of pinkish fawn.

Description of species (from No. K58, Boonsong Lekagul collection, Yala, Thailand): Body and tail very strongly compressed; head triangular, frontal area directed almost straight forward; rostral small, about as wide as high, bordered on each side by a supralabial, behind by three scales, the median enlarged; tip of snout somewhat elevated; nostril in a somewhat elevated nasal that is separated from rostral by three (or two) scales; canthus rostralis sharply defined, projecting, elevated, continuous with sharp supraciliary border which is strongly elevated reaching back to level of eye, then forming a sharp angle; snout, frontal and supraorbital areas, covered with small smooth unequal scales, largest being a series of three median scales on snout; peripheral scales large folded over edge with an upper and lower face exposed; a strong depression in occipital region with a few larger scales; loreal region nearly vertical, scales two or three times larger than those in orbital area. Eleven supralabials, followed, to angle of mouth, by several tiny scales; twelve to thirteen infralabials, followed by a few tiny scales to mouth-angle; diameter of orbit (16 mm.) only slightly longer than snout (15.6 mm.); tympanum distinct, its greatest diameter (6 mm.) less than length of eye-

opening (8 mm.); no enlarged scales above tympanum; a few just posterior to middle of orbit; mental very small, touching two enlarged scales the first of two series of scales, anterior ones larger than labials; a small distinct gular pouch and a transverse nuchal fold; a row of small median serrate scales begins near tip of chin, and runs back to base of gular pouch. Nuchal crest high, but less than diameter of orbit, continuous with dorsal crest which continues far onto tail; crest-scales triangular, serrate, anterior ones pointing slightly backwards; at base of crest-scales a row of equally large scales pointing upwards; below these on sides two other rows somewhat larger than lateral scales; lateral scales subequal, except a row of five enlarged scales beginning on shoulder and extending to above groin; low on sides scales increase in size to equal the smooth scales on venter, which are two to four times larger than lateral scales; most scales on chin and gular pouch small; caudal scales considerably enlarged, there being seven or eight rows at base; two subcaudal rows strongly keeled to near tip. Scales on outer faces of limbs larger than those on concealed surfaces; leg reaches eye; third and fourth fingers subequal in length; 23 scales under fourth toe; basal part of toes with two rows of scales, both keeled, keels terminating in spines, but toward end a single row, each scale with two keels; terminal scale much widened, equal to that at base of claw above. No preanal or femoral pores.

Color in preservative: Head greenish olive with several radiating dark lines above eye and two or three dim darker lines behind orbit; sides olive-tan with numerous longer or shorter black irregular striations on neck and sides; arms and legs brownish (when epidermis is shed the color is lavender), with some ivory marks on back part of forearm and front part of thigh; chin greenish yellow. Venter and underside of limbs ivory-white; tail with nine bands of brownish olive, the bands growing longer posteriorly and separated by subequal pinkish-fawn bands.

Measurements in mm.: Snout to vent, 140; tail regenerated for nearly half its present length; snout to angle of jaw, 45; snout to angle of supraciliary border, 34; greatest width between supraciliary borders, 25; greatest depth of body, 40; greatest depth of tail, 21.5; arm, 84; leg, 112.

Distribution: The type-specimen came from Trang, and three other specimens have been taken in the province of Yala.

I have seen a specimen from Gunong Tehu, Kuala Trengganu, Malaya.

Remarks: An examination of the Gunong Tehu specimen elicits the following data: The scales on the venter are large, smooth and the character of the scales on the limbs are practically identical in size and number of rows with the specimen here described. A slight fold of skin is evident back of the occiput, rising above tympanum and terminating on the midline near the occipital spot. In the described form it is not indicated. The height and character of the crests is the same in both; both have the row of enlarged distant scales begin near midway of the back somewhat below the base of the crest. The tip of the snout is elevated in both.

The species inhabits large forest trees and probably for this reason has remained rare in collections.

Goniocephalus borneensis (Schlegel)

Lophyurus bornensis, Schlegel, Bijdr. tot de Dierk., vol. 1, 1848, p. 6, pl. 3, fig. 2 (type-locality, Borneo?).

Gonyocephalus borneensis: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 288; *ibid.*, vol. 3, 1887, p. 493; Fasciculi Malayenses; Zoology, vol. 1, 1903, p. 153; Journ. Federated Malay States, vol. 3, 1908, p. 65; Robinson and Kloss, Journ. Federated Malay States, vol. 5, part 3, Oct. 1914, p. 154 ("Kao Nawng, Bandon *"); Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 53 (Bandon); Boulenger, A vertebrate fauna of the Malay Peninsula; Reptilia and Batrachia, 1912; pp. 65-66.

Diagnosis: A large lizard reaching a snout-vent length of 138 mm. a tail length of 328 mm.; a supraciliary and canthal ridge continuous, not strongly raised; a gular sac well developed; usually a Y-shaped series of larger scales on snout; an enlarged tubercular scale on each side of occiput; nuchal and dorsal crests continuous, composed of separated lanceolate scales, most of them as long as or longer than diameter of orbit; a diagonal fold across shoulder, tending to meet its fellow on throat; tympanum distinct. Body and tail compressed.

Description of species (from EHT-HMS No. M. 2 (8623)): Head with the canthal and supraciliary edges continuous, somewhat overhanging, reaching summit above eye and descending a short distance behind eye; rostral moderately large, bordered laterally by a supralabial and seven postrostrals; nostrils in a single nasal, separated from the rostral by a single scale, and from its

* This locality (lower camp) is described as "situated on the upper reaches of the river flowing past Ban Kok Klap, probably about fifteen miles distant from that place at a height above sea-level of about 1,200 feet and quite close to the divide leading down to Nakon Sitamarat."

A second camp, Kao Nawng (upper camp) was established also. "During our stay on the mountain a part was detached for work at higher elevations and a camp was established at about 3,500 feet, a few hundred feet below the extreme summit of the range in a saddle between two peaks."

fellow by eleven scalerows; scales on top of head rough, irregularly keeled; a more or less distinct Y-shaped series of scales on snout; frontal and interorbital areas depressed, scales smaller than supra-orbital scales; a pair of spinelike scales in occipital region; eleven supralabials, two or three showing faint keels near their lower borders; ten infralabials. Mental rather small bordered by two labials and two enlarged scales, each first of a series of three or four enlarged scales; a throat pouch (better developed in old males); scales on sides of body small, somewhat variable in size growing larger near crests and low on sides; scales pointing upward on upper anterior part of side; farther back and lower on sides they may be directed backwards or backwards and downwards; scales on chin and venter strongly keeled, those on chin and throat smaller; a diagonal skinfold in front of shoulder reaching throat followed by a small depressed "pocket" with fine scales; arms and legs with large keeled scales, keels often forming continuous lines; scales on compressed tail much larger than those on sides; several rows of heavily keeled scales under base of tail; a very small serrate crest indicated on base of tail; nuchal and dorsal crests continuous, the crests composed of narrow soft compressed lanceolate spines longer than diameter of orbit; on each side of crests two or three rows of small upright soft spines, outermost shortest; an indefinite dorsolateral row of enlarged scales with other enlarged, often tubercular, scales lower on sides; some enlarged scales above, below, in front, and behind tympanum which is well developed, superficial; a slight fold of skin just back of occipital region beginning above tympanum. Leg reaching nostril; twenty-three scales under fourth toe; basally there are two scales, each keeled distally.

Color: Top and sides of head olive; throat-pouch bluish, the scales with black bases; side variegated olive and lavender with some blackish flecking. Enlarged scales often blue; dorsal and nuchal crests bluish to ultramarine with black at base of crest above shoulders; tail banded gray-olive and whitish. A blackish area in front of shoulders; venter and under thighs amber.

Measurements in mm.: Snout to vent, 130 mm.; tail, 278 (tip missing); width of head, 25; length of head, 40; diameter of orbit, 13; length of snout, 16; height of nuchal-crest spines, 18; dorsal crest, 13; arm, 76; leg, 112.

Variation: The described specimen has the head scales larger and rougher than two other specimens examined. There is a decided swelling back of the angle of the mouth in older males. Most

of the scales of the body are keeled and often mucronate; a single hairlike projection extends from below the apex of the scale. A few of the head scales lack a spine and may have two or three small hairs. The sutures of the labials may be dark.

Distribution: The species, first discovered in Borneo, has been taken in Malacca, Perak (3600 ft.), Pahang, and Selangor.

In Thailand it has been reported only once near the border of Surat Thani and Nakhon Si Thammarat. Two camps are mentioned at Kao (Khao) Nawng, one at 1500 ft. one at 3500 ft. The report by Robinson and Kloss does not give the elevation.

It lives in high trees and is not easy to detect. It probably occurs in suitable mountain localities from Surat Thani south into Malaya.

Goniocephalus grandis (Gray)

FIG. 49

Dilophrys grandis Gray, Catalogue of the lizards in the collection of the British Museum, 1845, p. 239; Cantor, Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 640, pl. 20; Günther, The reptiles of British India, 1864, p. 136.

Gonyocephalus grandis: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 298; The fauna of British India, Reptilia and Batrachia, 1890, p. 124; Fasciculi Malayenses, Zoology, vol. 1, 1903, p. 153; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, p. 66; M. Smith, Bull. Raffles Mus., no. 3, 1930, p. 24 (Setun [Setul]).

Diagnosis: A large species with a snout-vent measurement often exceeding 155 mm. with a total length of 405 mm.; crests outlining top of head, especially supraciliary border, not very strongly elevated (compared with *abbotti* and *chamaleontinus*); nuchal crest not continuous with the dorsal crest but very strongly elevated, built up of several superimposed rows of scales surmounted by about 30 scales, middle ones greatly elongated, connected with each other but with a short free serrate edge; after an interval, a dorsal crest less than half elevation of nuchal crest, the individual elongate scales fused except for a serrate edge, terminating posteriorly on a level with vent. Body and tail compressed; snout somewhat depressed above.

Description of species (from No. M. 138,* EHT-HMS collection from Bukit Lagon Forest Reserve, Kepong, Selangor, Malaya): Rostral small, barely in contact with a labial on each side, and followed behind by five postrostrals; nostril pierced in a single nasal, that is separated from rostral, and likewise from supralabials by two or three scales; nasals separated from each other by about 12

* Males in the collection from Thailand are immature and I have chosen an adult Malayan male for the description (received through the courtesy of Mr. Lim Boo-Liat).



FIG. 49.—*Goniocephalus grandis* (Gray). No. 34678♀. 14 km, northeast Bhetong, Yala. Actual snout-vent length, 112 mm.

scales; canthal and supraciliary scales continuous, enlarged, separated by a gap from postocular series; anterior part of snout flattened but a slight longitudinal ridge present on middle of frontal area; supraorbital areas elevated, limited mesially by a curving row of larger scales; these rows separated by ten scalerows, occupying a deep depression between them; scales in middle of supraorbital areas somewhat larger than others. A strongly curving series of somewhat enlarged scales paralleling posterior curve of orbit with a short row of similar scales extending back from it to above tympanum, terminal scale largest; another enlarged tubercular scale between tympanum and crest; tympanum moderate, superficial, its greatest diameter (6 mm.) greater than half length of eye-opening (9.5 mm.); length of snout in front of eye (18 mm.), greater than diameter of orbit (15 mm.); twelve or thirteen supralabials, last small; eleven or twelve infralabials; mental small, triangular, bordered by a labial on each side, and two enlarged scales first of two series of four. No longitudinal serrate series of scales on chin and throat; nuchal pouch scarcely indicated; diagonal fold on neck is indicated; a distinct swelling on area behind jaw-angle; scales on middle of chin and neck smaller than those along infralabials and on swellings. Scales on sides of neck and body very small, subequal, smooth, becoming a little larger as they approach the venter and dorsal crest. Scales on venter subequal, larger than other scales on body; scales on tail about size of ventral scales, except that two median scalerows below tail are enlarged and keeled on basal half. Body and tail strongly compressed.

The nuchal crest consists of several fine series of scales surmounted by four larger series, one above other, pointing upwards and these surmounted by a weblike series of about 30 scales, small anteriorly and posteriorly but much elongated mesially with a short serrate edge; this extends from near level of orbits to above arm-insertion. Dorsal crest beginning shortly behind notch following nuchal crest, composed of elongate spines pointing upward, together forming a weblike structure with a short serrate edge above, terminating above vent.

Arms and legs strong; wrist reaching snout, leg reaching front of orbit; middle fingers equal in length; 36 lamellae under fourth toe, each with a median keel. Scales on sole and palm keeled or spinose; many scales on limbs and base of tail beset with three or fewer fine hairlike structures emerging from posterior part.

Color: Generally lavender-brown above with a series of bluish-gray bands on limbs and digits; venter lavender-olive with about

ten cream ventral bands reaching sides and continuing as a series of separate cream spots covering six to ten scales; these may reach halfway up on sides of body; tail strongly banded in bluish white and brown bands, narrow basally but growing longer distally; ten or eleven bands of each color. Chin and throat cream with olive-brown longitudinal streaks. Nuchal crest light brown, dorsal crest nearly lavender.

Measurements in mm. of *Goniocephalus grandis*

NUMBER	M. 138	34434	34678
Sex.....	♂	♀	♀
Snout to vent.....	154	100	112
Tail.....	396	194	145
Snout to arm insertion.....	60	38	46
Axilla to groin.....	70.2	45	49
Head width.....	36	20	18
Head length.....	51	30	32
Height of nuchal crest.....	26	6	6
Height of dorsal crest.....	13	2	2
Arm.....	78	53	57
Leg.....	127	85	98

Variation: Two young specimens from 15 km. NE of Bhetong, Yala, were brown in life, the nuchal crest variegated brown with a light-tan band from eye running back and meeting its fellow on the notch following the nuchal crest; below this, beginning on eye, a broad dark-brown band, involving upper part of tympanum, passes back joining its fellow on shoulder; four other diagonal bands cross body more distinct in the younger smaller specimen (No. 34434).

The larger specimen No. 34678 has the terminal 65 mm. of the tail regenerated. It is cylindrical rather than compressed and the scales are sharply keeled and often spinose rather than smooth. This is in odd contrast to the basal part of the tail. The ventral surface is an indefinite brownish white clouded but not showing clearly the ventral bands although these are indicated on sides. The streak under chin and throat are indicated.

A single female from Malaya was examined. This shows, the head dark brown above with five or six very narrow light transverse marks; two light chevrons on neck bordered by two black chevrons, the lower widening somewhat on shoulder; four or five other light chevron bands across back, each with a dim darker

median line separated by wide dark area on upper part of sides while lower sides are speckled with light spots; the ventral bands are obscured; arm, hand, tibia, and foot strongly banded with gray; chin streaked. The nuchal crest on the female is low but distinguishable, but the dorsal crest can scarcely be said to be present. Snout-to-vent length is 125 mm.

A large male (No. 182 Raffles Mus.) from Pulao Tioman shows the streaks under chin and throat blue with considerable bluish color low on the sides and less on venter. This specimen is generally darker (nearly blackish on sides. Its snout-to-vent length is 150 mm.).

Distribution: The species is known in the following Thai provinces: Setul, Yala, Songkhla, and Pattani.

Outside of Thailand the species occurs in Sumatra, Borneo, Nias, Mentawai Islands, Malaya, and Pulao Tioman.

Remarks: Specimens occasionally are seen in shrubs or small trees growing in small ponds or streams. These may dive and swim several meters underwater.

Genus CALOTES Cuvier

Calotes Rafinesque, Anal. Nat., 1815, p. 75 (*nomen nudum*).

Calotes Cuvier, Règne Animal, vol. 2, 1817, p. 35 (type, *Lacerta calotes* Linnaeus).

Lophodeira Fitzinger, Systema reptilium, 1843, pp. 15, 46 (type *Bronchocoela cristatellus* Kaup).

Diagnosis: Teeth mostly acrodont, compressed except canines and incisors which are at least semithecodont and may be replaced; body compressed for arboreal habitat; tail often two to three times length of head and body; a dorsal crest usually present, higher in males; femoral and preanal pores absent.

The genus is distributed throughout southern and southeastern Asia from Afghanistan and the Thibetan border through India to Ceylon; east to southern China, Indo-China, Malaya; through the Malayan Archipelago to the Philippines but not reaching to New Guinea.

In Thailand the genus is represented by five well-defined species each showing considerable variation in the number of scales around the middle of the body and in color and markings. It seems probable that this scale variation betokens subspecific differentiation worthy of recognition in some populations; however, insufficient material is available to me, to make a decision on the matter.

Certain of these variables have already been named and thrown into synonymy by other workers.

The ability of these animals to change color is probably not exceeded even by the chamaeleons. A brilliantly colored male may in the matter of one or two minutes change so as to be unrecognizable as the same individual. The sexual differentiation is strongly marked. In males of the various species the gular pouch is more or less developed; the nuchal and dorsal crests are higher, and the coloration, at least during the breeding season, is much more brilliant than in females.

Courtship has been observed in several species. I quote from Malcolm Smith (1935, p. 198) on *Calotes mystaceus*: "The courtship which continued until the eggs were laid . . . consisted for the most part of absurd bowings and noddings of the head. This was commenced by the male, and usually, after a short time, responded to by the female. The pair faced each other on these occasions, arching their backs and puffing out their throats to the full extent. The vivid hues assumed by the male (and slightly so by the female) during this performance transformed him into a truly gorgeous creature. The head and fore-part of the body became of a light electric blue, sometimes green colour, the gular pouch dark purple, whilst the pale stripe which borders the upper lip and passes on to the shoulder turned almost white and stood out in strong contrast to the other colors."

Deposition of the eggs by the female is usually accomplished after the female has dug a hole in relatively hard earth. I have watched and reported on the egg-laying of a Ceylonese species, *Calotes calotes*.

Several specimens of this species, normally a dark green animal with vertical whitish spots, were discovered digging in the hard earth of a well-travelled elephant-path. All were now nearly black without scarcely a trace of the green color. The holes were of various depths. In none were eggs seen at this time.

Somewhat later in the day, I observed a single female depositing eggs in a completed hole. After a certain number of eggs were deposited, the loose dirt was dragged over them and, using the head as a pile driver, she pounded the earth above them. Then followed another period of egg laying and a similar filling in of the hole with loose earth, and the same pounding tactics. After the last egg had been laid the hole was completely filled in and pounded until the

surface was on a level with the surrounding earth. Then, fragments of leaves, sticks, and other objects were spread over the area hiding the location of the nest from possible predators.

Color changes in the lizards may be induced by various means. A specimen captured in the daytime and placed in a dark collecting bag may change to less colorful hues; on the other hand, specimens of a dull-colored male after a night in captivity may appear highly colored. The changes also take place during the sexual excitement of courtship. Smith reports that fear such as is induced by placing a serpent with captive specimens, will cause the male to assume his brilliant nuptial colors. "They invariably faced the snake bowing to it and nodding their heads exactly as when courting. The crest was strongly erected, the pouch fully distended, and the colours became gradually more vivid until they were almost as intense as during sexual excitement."

The Thai name is *ginka* and is widely used in areas where Thai is spoken, for the various species of the genus *Calotes*. In places the name is also applied to species of *Goniocephalus* and *Physignathus*. Species of the gliding ("flying") lizards are members of the same family *ginka-bia*.

KEY TO SPECIES OF CALOTES IN THAILAND

1. Lateral scales in rows pointing backwards and downwards 2
 Lateral scales in rows pointing backwards and upwards 3
2. Dorsal scales keeled; ventrals strongly keeled, three to five times larger than the dorsals. The six to ten dorsal scalerows pointing backwards and upwards; lateral scales point backwards and downwards; gular scales smaller than ventrals; color generally green in life but capable of changing; 60 to 100 scales around the body . . . *cristatellus*
 Dorsal scales smooth or feebly keeled, larger than the median ventrals, all rows pointing backwards and downwards; gular scales as small or a little smaller than ventrals; color generally light brown around body *floweri*
3. No fold or pit with small scales in front of shoulder; two spines above the tympanum; throat and chin with longitudinal dark streaks; color generally fawn with brownish or blackish marks or bars; 35 to 52 scales around body at middle *versicolor*
 A fold or pit with small scales in front of shoulder 4
4. No postorbital spine present; the fold in front of shoulder oblique, with fine granular scales in the fold; a cream stripe along upper lip extending well onto shoulders; male with three to five large reddish brown or dark brown spots on sides; 48-52 scales around body, *mystaceus*
 A postorbital spine present 5

5. A large well-defined postorbital spine (or two small groups of spines) above tympanum on occiput; a diagonal or angular fold on shoulder about a shallow pit, its bottom covered with fine granular scales, deep black in color; 40-48 scales around middle of body,

emma emma

A very low postorbital tubercle or spine; two low tubercles or spines above tympanum; 60-65 scales around the middle of body; a high nuchal crest. *emma altacristatus* *

Calotes cristatellus (Kuhl)

FIG. 50

Agama cristatella Kuhl, Beitr. Zool. vergl. Anat., vol. 1, 1820, p. 108 (type-locality, not designated).

Bronchocoela cristatella: Kaup, Isis, 1827, p. 619; Duméril and Bibron, Erpétologie générale . . ., vol. 4, 1837, p. 395 (East Indies).

Calotes cristatellus: Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 316; Ann. Mus. Civ. Genova, ser. 2, vol. 6, 1888, p. 318; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 134; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 70; Flower, Proc. Zool. Soc. London, 1896, p. 871; *ibid.*, 1899, p. 639; Baumann, Zoolog. Jahrb., System., vol. 34, 1913, p. 266, fig. B; de Rooij, The reptilia of the Indo-Australian Archipelago, vol. 1, 1915, pp. 121-122, fig. 53; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 2, Aug. 1914, p. 130; *ibid.*, no. 3, Mar. 1915, p. 154 (Sai Yoke district); *ibid.*, vol. 2, no. 1, June, 1916, p. 54; *ibid.*, no. 2, Dec. 1916, p. 155 ("Bangnara" [= Narathiwat] and Klong Bang Lai, "Patiyu" [= Chumphon]); Bull. Raffles Mus., no. 3, Apr. 1930, p. 27; Journ. Federated Malay States, vol. 10, 1922, p. 269.

Agama guttorosa Merrem, Tentamen systematis amphibiorum, 1820, p. 51 (type-locality, "America" based on Seba, vol. 1, p. 1, pl. 89, figs. 1-2).

Agama moluccana Lesson, Voyage Coquille; Reptilia, 1830, pl. 1, fig. 2 (type-locality?).

Bronchocoela burmana Blanford, Journ. Asiat. Soc. Bengal, vol. 48, 1878, p. 127 (type-locality, Tavoy, Burma).

Diagnosis: Scales on sides pointing backwards and downwards; no skinfold or pit anterior to shoulder. The hind limb reaches to eye or farther; fourth finger as long as fifth toe; six to ten upper scalerows pointing backwards and upwards; strong nuchal crest in male; dorsal crest lower. Snout to vent, 130 mm.; tail, 440. Body much compressed.

Description of species (from No. 134 ♀ La Doo Tin Mine near Bendang Stah, Yala): Body much compressed; rostral very small about one third of the size of mental, bordered laterally by labials, and behind by three postrostrals, separated from nasal by three or four scales; nasal angular separated from labial series by one scalerow; canthal edge sharp, scales relatively small, continuous with supraciliaries; frontal area concave continuous with a concave

* The question as to whether this should be regarded a subspecies or a full species is not fully decided. There seems to be a considerable hiatus between their ranges; they are here regarded as subspecies.



FIG. 51.—*Calotes versicolor* (Daudin). No. 349, Songkhla, Songkhla, Thailand.
Snout-vent length, 97; tail, 262 mm.

area between orbits; scales on snout keeled or ridged, subequal, a little smaller than keeled scales above orbits; two or three enlarged scales in occipital region; a somewhat enlarged scale at posterior end of supraciliary border followed by a series of three compressed scales; tympanum large superficial, its diameter (4.5 mm.) half diameter of orbit (9 mm.); supralabials, 10-11 with a longitudinal keel, and a slight elevation on labial edge; 10-11 infra-labials, a distinct keel and an elevation on labial border giving scales a troughlike appearance. Mental with a labial border much greater than that of rostral, bordered behind by a pair of chinshields separated by a scale; these followed by a diverging series of larger scales, that diminish in size and become similar to adjoining scales. Scales on back of head, on neck, and front of shoulders, small, high, compressed; scales farther back are lower, elevated parts are keels which may be higher at one end of the scale than at the other; keeled scales on back and sides for most part directed backwards and downwards, except six or eight upper rows which are directed backwards and upwards; a nuchal crest composed of about ten flattened scales reaching their greatest height (5 mm.) at middle of series; dorsal crest very low serrate; scales on tail larger, longitudinally keeled, the series pointing directly backwards; scales on chin strongly keeled, larger than those on head above; a slight nuchal pouch in males; ventral scales much larger than dorsal and laterals, strongly keeled, somewhat mucronate, keels parallel; subcaudal scales moderately keeled; scales on arms and legs enlarged, keeled.

Arms and legs slender, elongate, leg reaching a little beyond eye; third and fourth fingers subequal; fourth toe much longer than third; subdigital lamellae with double keels, rarely with three keels. About 90 scales around body; small fold from jaws runs back to shoulder.

Color in life: Whole body green, nearly uniform; this changed in a few minutes, showing a tail banded with gray-brown and ultramarine; two large chocolate brown patches on sides of rump; in fixative dark blackish brown with light brown transverse bars across back; proximal part of tail similarly marked, light and darker bands of nearly same width; distal bands blackish brown and ultramarine the dark bands several times wider than the light. Chin yellow-green; throat bluish especially laterally; venter lavender; underside of arm cream, of leg, bluish white.

Measurements in mm. of Nos. 1349, and 1534, respectively: Snout

to vent, 110, 122; tail, 374, 454; width of head, 19, 20.5; length of head, 33, 38; snout to arm-insertion, 43, 45; axilla to groin, 56, 68; arm, 55, 63; leg, 93, 104.

Variation: The series of compressed scales back of the supra-ciliary border vary in size, being usually more evident in males; the number of scalerows about the body at the middle varies (in the entire range) from 60 to 100 strongly suggesting subspecific differentiation in certain of populations. In Thailand the variation is less than ten in specimens I have examined. However, Malcolm Smith states that specimens from the extreme north (Sai Yoke district Kanchanaburi and Patiye, Chumphon have 60-62 scales) which is a difference of 30 or more scalerows. I have not examined specimens from these localities.

Distribution: In Thailand the species is confined to the peninsular area, and the adjoining mainland north of the peninsula. It has been taken in Kanchanaburi, Chumphon, Narathiwat, Yala, and Pattani provinces, but may be expected in all provinces in the peninsula. It is wide-spread in Malaya.

Remarks: This species changes color very rapidly. One may see a brilliant green lizard one minute and a short time later it may turn almost completely black. If such a specimen is left undisturbed for a few hours in the dark it may resume the brilliant green coloration.

The eggs are oval; oviductal eggs measure about 30 by 12 mm.

Calotes floweri Boulenger

Calotes floweri Boulenger, The fauna of the Malay Peninsula from the Isthmus of Kra to Singapore; Reptilia and Batrachia, 1912, p. 70 (type-locality, Siam and the Malay Peninsula [restricted to Chanthaburi Thailand by Taylor and Elbel]); M. Smith, Journ. Federated Malay States Mus., vol. 10, 1922, p. 269; Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 54; The fauna of British India including Ceylon and Burma . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 186-187; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1097-1098 (type-locality restricted).

Calotes microlepis: (not of Boulenger) Boulenger, Journ. Federated Malay States Mus., vol. 3, 1908, p. 66.

Diagnosis: Forehead flattened with an inverted Y-shaped series of enlarged scales; dorsal and lateral scales keeled, pointing backwards and downwards; 48 to 64 scales around body; nuchal crest composed of erect, compressed spines. Head large, its length twice its width.

Description of species (from EHT-HMS No. 31717): Head relatively narrow, its length twice its width; frontal region flat, dis-

tance between edge of orbit and nostril slightly greater than diameter of orbit. Rostral wide, low, bordered behind by two labials and five postrostrals; a group of enlarged scales form an inverted Y-shaped figure, scales forming branches of the Y, continuous with two enlarged "semicircular" scale series on inner border of supraocular region, separated from each other by three scalerows; at level of occipital scale (bearing "pineal eye") a transverse row of slightly elevated scales, with a few enlarged scales on each side of occipital region; scales in temporal regions unequal with one differentiated series from eye to above tympanum. Twelve supralabials, last three not clearly differentiated; eleven infralabials; mental narrow, as wide as long, followed by two enlarged rows of six scales each and except for first, separated from each other by one row of scales anteriorly, to five rows posteriorly. About 64 scales in a transverse row around body, dorsal and lateral scales arranged in longitudinal rows that point backwards and downwards; dorsal scales subequal in size in more or less distinct transverse rows, larger than those on the venter, but the scales on venter more strongly keeled.

Body strongly compressed; legs slender; a gular pouch scarcely discernible; tail definitely compressed but swollen and serrate at base, median scales somewhat larger than the rest.

Color: Generally light brown above; four indefinite darker brown marks present on dorsum, first between shoulders; tip of head darker, with radiating dark streaks from eye; venter very light brown with or without dark marks; tail lighter than body, barred with bands of brown and light tan.

Measurements in mm.: Snout to vent, 98; tail, 180 (from type description).

Variation: The supralabials vary between eight and twelve in number. The nuchal crest which in both sexes is composed of from six to nine erect compressed spines, is lower in females. The dorsal crest forms a serrated ridge in the male but is absent in the female. In the male the tail is thickened and swollen at the base.

Distribution: The species was originally discovered in mountains near "Chantaboon" = Chanthaburi, southeastern Thailand at an elevation of about 1500 ft. The species has also been taken in Cambodia at 3000 ft. and in Malaya at from 6000-7000 ft. elevation.

Remarks: The specimen described has scales smaller and in larger number than the type specimen described by Boulenger. In

consequence it resembles somewhat the species *C. microlepis* (scalerows around body 65-72), described by Boulenger from southern Burma. It is possible that *microlepis* and *floweri* are subspecies of a single species. Sufficient material is not available to determine this. The specimen here considered may be somewhat intermediate in character between the two.

Calotes versicolor (Daudin)

FIG. 51

Agama versicolor Daudin, Histoire naturelle générale et particulière des reptiles, vol. 3, an X=1802, pp. 395-397 (type-locality [based on Kuhl] Pondicherry, designated by Malcolm Smith).

Calotes versicolor: Jerdon, Journ. Asiat. Soc. Bengal, vol. 22, 1853, p. 470; Blyth, Journ. Asiat. Soc. Bengal, vol. 22, p. 649; Günther, The reptiles of British India, 1864, p. 140; Theobald, Journ. Linn. Soc., vol. 10, Zoology, 1868, p. 33; Anderson, Proc. Zool. Soc. London, 1872, p. 381; Blanford, Zoology of Eastern Persia, 1876, p. 313; Anderson, Anatomical and zoological researches and zoological results of the Yunnan Expeditions . . . 1878-79, p. 805; Murray, The vertebrate Zoology of Sind, 1884, p. 367; Tirant, Notes sur les reptiles et les batraciens de la Cochinchine et du Cambodge, 1885, p. 89; Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 321; The fauna of British India . . . Reptiles and Batrachians, 1890, p. 135, fig.; Flower, Proc. Zool. Soc. London, 1899, p. 639; Annandale, Proc. Zool. Soc. London, 1900, p. 858; Journ. Asiat. Soc. Bengal, vol. 73 Suppl. 1904, p. 18; M. Smith and Gairdner, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 3, Mar. 1915, pp. 130, 154 (Rat Buri, Petchaburi); M. Smith, *ibid.*, vol. 2, no. 1, 1916, p. 54; *ibid.*, no. 2, 1916, p. 155 (Narathiwat, Pattani, Nakhon Si Thammarat); *ibid.*, vol. 4, no. 2, p. 96; Mell, Arch. Naturges., Bd. 88, 1922, p. 112; Chabanaud, Mission Babault résultats scientifiques, reptiles et batraciens, 1922, p. 4, pl. 1, fig. 1; Proctor, Journ. Bombay Nat. Hist. Soc., vol. 29, 1923, p. 123; Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 415; Jouquet, Journ. Bombay Nat. Hist. Soc., vol. 33, 1929, p. 452; Deraniyagala, Ceylon Journ. Sci., sec. B, vol. 16, 1931, p. 150; Brongersma, Mem. Mus. R. Hist. Nat. Belgique, vol. 5, 1931, p. 19; M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 189-193, fig. 54; Baldauf, Copeia, 1949, pp. 289-290; Randow, Aquar. Terrar. Z. Stuttgart, vol. 5, 1952, pp. 185-187; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1098-1099 (Rat Buri, Kanchanaburi, Chaiphaphum, Nakhon Si Thammarat, Rayong, Phatthalung and Loei); Mertens, Aquar. Terrar. Z. vol. 7, 1954, fig. (Pakistan); Leviton, Myers and Swan, Occ. Papers Nat. Hist. Mus. Stanford Univ., no. 1, 1935, pp. 1-18, Deraniyagala, Spolia Zeylanica, vol. 28, 1, pp. 7, 16.

Diagnosis: Head relatively short; scales on the sides of body pointing backwards and upwards; no fold in front of shoulder; two spines (or groups of spines) above tympanum; light brown, fawn or grayish with darker markings; throat and chin with longitudinal darker marks that are continuous with radiating lines from eye; a dim median dark line on venter; moderate nuchal and dorsal crests continuous, of lanceolate compressed spines, the size diminishing gradually posteriorly; base of tail in males thickened, scales larger and thicker than in females.

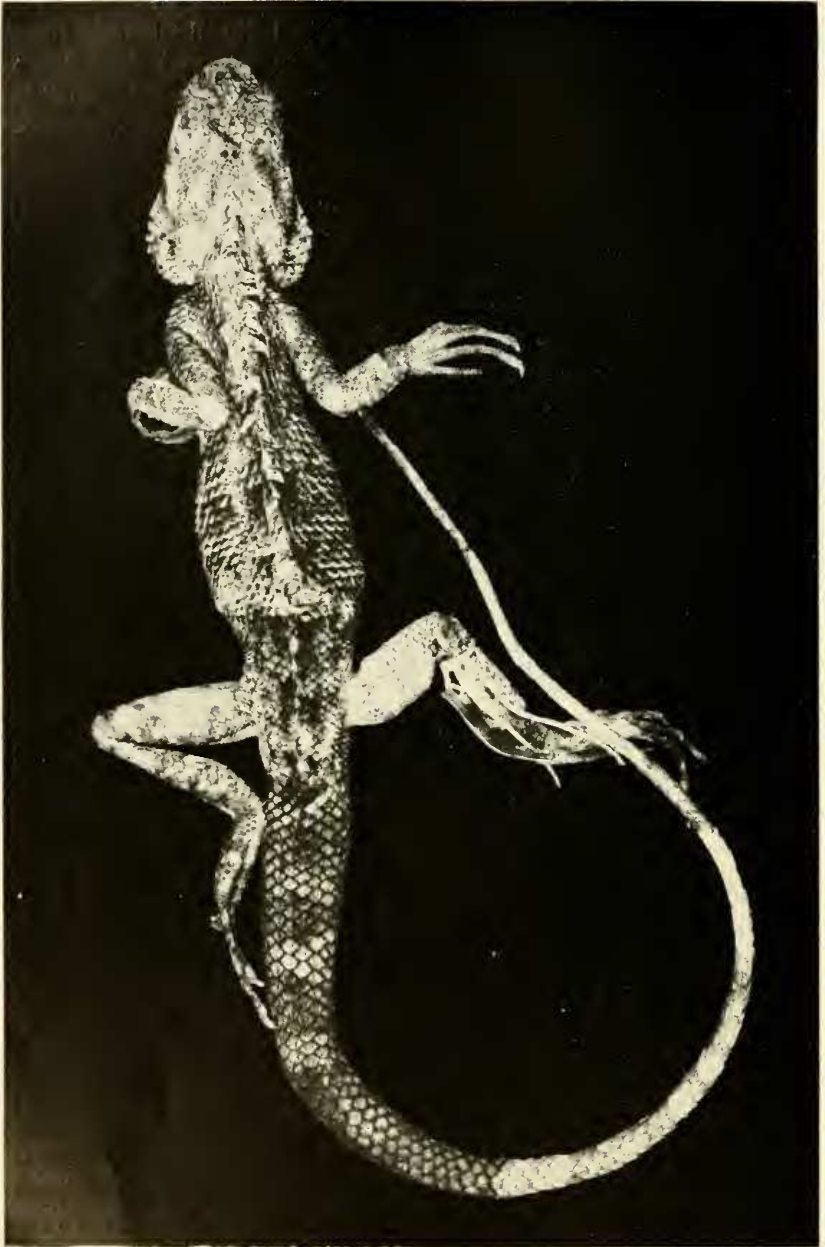


FIG. 50.—*Calotes cristatellus* (Kuhl). EHT-HMS No. 205 Ulu Langat Forest Reserve Kajang, Selangor Malaya. About natural size.

Description of species (from No. 348, Songkhla, Songkhla): Head not or scarcely concave in frontal area; rostral small, about one and one-third times as wide as high (rarely larger), bordered by two labials and three postmentals; nasal with nostril directed outward, separated from rostral by two scales; scales on head varied in size, smooth; median occipital scale (with pineal eye) enlarged; two separated spines, or groups of spines above tympanum; jaws swollen (in male); tympanum slightly sunk, about one half of diameter of eye; canthal and supraorbital edge sharp; ten or eleven supralabials; ten infralabials; mental small, wider than rostral, and larger; a pair of narrow chinshields touching labials each followed by a row of three or four enlarged scales, none touching labials; orbital diameter less than length of snout; gular scales mucronate distinctly larger than ventrals, the scalerows directed mesially; dorsal and lateral scales not keeled; ventrals, keeled and mucronate; basal part of tail swollen, scales keeled and mucronate, basal scales thickened; no caudal ridge or crest; nuchal crest continuous with dorsal, the highest scales about five millimeters high; dorsal crest terminates at base of tail; third and fourth fingers subequal, with 21 scales on their under-surface each with two projecting spines; fourth toe much longer than third with 26 scales similar to preceding scales on finger; leg reaches to near back edge of orbit; 46 scales in a row around body at middle.

Color: Variegated brown and dark olive the latter forming six or seven darker marks on back and more or less connected with an indefinite reticulation on sides; many of the scales with whitish or cream-colored edges suggesting indefinite lighter bars; tail barred with light and darker olive, markings growing very indefinite distally; in basal part of tail skin between scales blackish.

Measurements in mm.: Snout to vent, 98; tail, 260; snout to arm-insertion, 35; axilla to groin, 45; width of head, 24 at tympanum, at temporal region, 18; length of head, 33; arm, 45; leg, 73.

Variation: Some specimens may have a narrow greenish-white dorsolateral line which interrupts the transverse dark markings. In some specimens the darker bands are more or less continuous under the tail. Occasional specimens have the head almost black with black lines on supralabials and infralabials. It is possible that these variations may occur in the same individual at different times.

Distribution: The species is widespread in Thailand and prob-

ably it occurs in all the provinces. It is common in the city of Bangkok in gardens and trees and along fences. Outside of Thailand the species ranges from Afghanistan, India and Ceylon east to Hong Kong, Indo-China, Malaya, and Sumatra.

Remarks: Within this great range some of the variants differ sufficiently to be regarded as subspecies. Whether the Thailand form is typical cannot be ascertained at this time. One Indian form reaches a size nearly a half larger than the typical-sized adults of Thailand.

Aside from the provinces from which this species has been reported, I have taken it also in Phra Nakhon, Ayutthaya, Khon Kaen, Nong Khai, Ubon, Sara Buri and Nakhon Ratchasima.

Annandale reports a remarkable behavior in courtship in one form of this species.

"The males are pugnacious and change color as they fight. In courtship the male approaches the female concealed in the foliage. He chooses a conspicuous station and advances towards the female. He is now a pale yellowish flesh color with a conspicuous dark spot on the gular pouch which is fully distended. He stands upright raising the fore-part of the body as high as possible, nodding his head solemnly up and down. As he does this the mouth is opened and closed rapidly and repeatedly."

Calotes mystaceus Duméril and Bibron

FIG. 52

Calotes mystaceus Duméril and Bibron, *Erpétologie Générale* . . . vol. 4, 1837, p. 408 (type-locality, Burma); Blyth, *Journ. Asiat. Soc. Bengal*, vol. 21, 1852, p. 354; Theobald, *Descriptive catalogue of the reptiles of British India*, 1876, p. 106; Boulenger, *Catalogue of the lizards in the British Museum*, 2nd ed., vol. 1, 1885, p. 325; *The fauna of British India* . . . Reptilia and Batrachia, 1890, p. 138; Annandale, *Journ. Asiat. Soc. Bengal*, vol. 73, 1904 (2) Suppl., p. 18; M. Smith, *Journ. Nat. Hist. Soc. Siam*, vol. 1, March 1915, no. 3, p. 154 (Sai Yoke district); *ibid.*, no. 4, Dec. 1915, pp. 256-257 (Paknampo; Hua Hin); *ibid.*, vol. 2, no. 1, June 1916, p. 54 ("Common and widely distributed extends as far south as Bangsaphan Lat. 11° 13'"); *Proc. Zool. Soc. London*, 1921, p. 429; Taylor, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 86, 1934, p. 295 (Chiang Mai); M. Smith, *The fauna of British India, Ceylon and Burma* . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 197-199; Romer, *Journ. Bombay Nat. Hist. Soc.*, vol. 48 (2), 1949, pp. 374-376.

Diagnosis: Scales on the sides of the body pointing backwards and upwards; an oblique fold and triangular pit in front of shoulder covered by small granular scales; dorsal scales larger than ventrals; no postorbital spine; fourth toe distinctly longer than third; 48-58 keeled scales round middle of body; nuchal and dorsal crests continuous; a white stripe on upper lip and side of head passing through tympanum to shoulder.

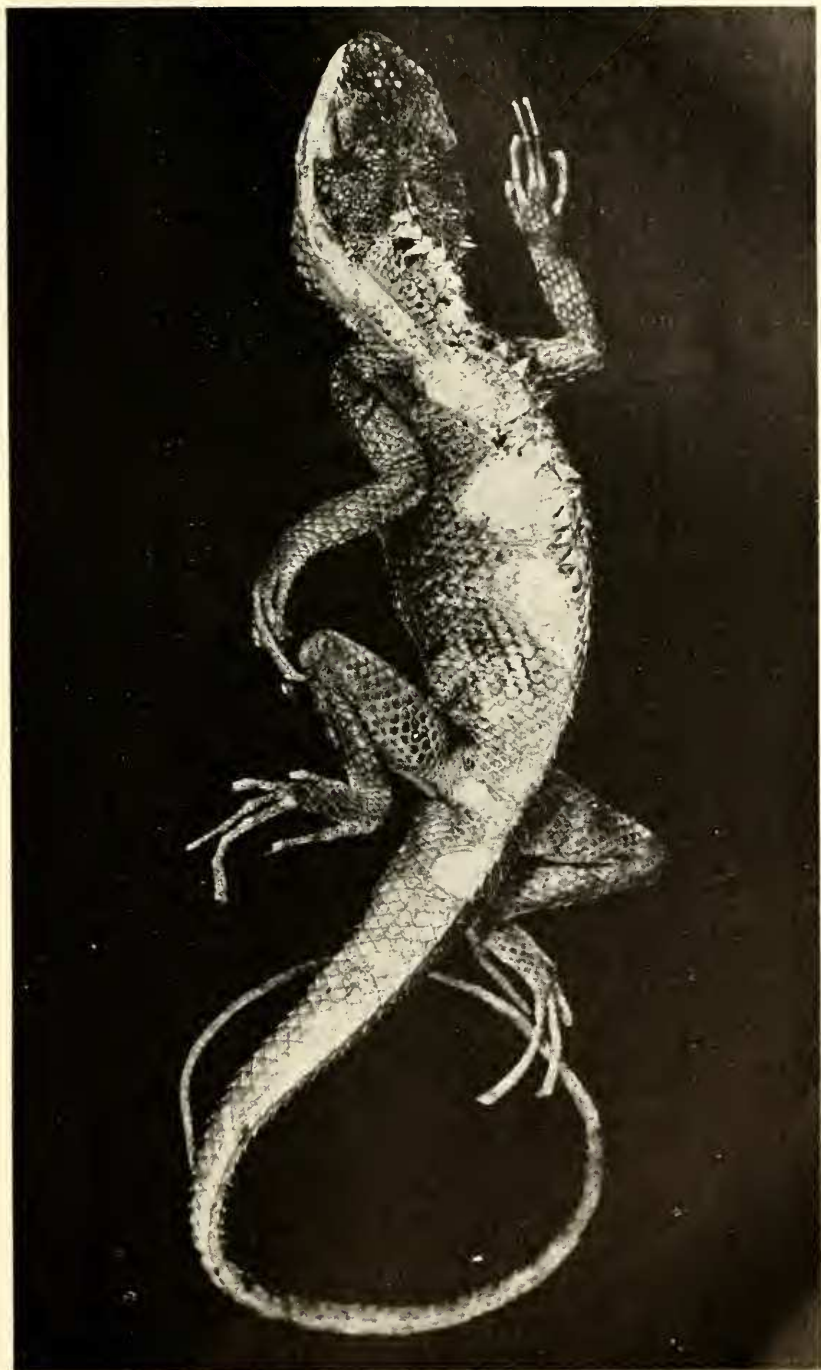


FIG. 52.—*Calotes mystaceus* Duméril and Bibron. No. 1486, near Kanchanaburi (km. 111). Actual length, snout-vent 110; tail, 228 mm.

Description of species (from No. 1481 Kanchanaburi province): Large species, area back of jaw-angle swollen, length of head about one and a half times its breadth; snout longer than orbit; rostral small, bordered by five postrostrals and laterally by a labial; frontal region shallowly concave; nostril in a single somewhat craterlike scale, directed outwards and somewhat backwards, separated from rostral by a scale; one or two larger scales above nasal; a longitudinal row of four bluntly ridged or keeled scales on middle line of snout; a patch of somewhat larger scales above on eyelids and another area on each side of occiput, the scales rough, some more or less keeled; canthus rostralis distinct, canthal scales more or less continuous with supraciliary series; supralabials 12-12, separated from small scales of orbit by three scalerows; an irregular row of larger scales from orbit to above tympanum; latter distinct, superficial, its diameter nearly half length of orbit; in area above tympanum two groups of scales consisting of a median elevated spine surrounded by three or four smaller spines; infralabials, 10-10; mental small, triangular, its labial border much smaller than rostral border; mental bordered by a pair of chinshields, not in contact, each followed by two enlarged scales, the series diverging, only first touching infralabials; scales on chin and throat rather large, keeled, mucronate or terminating in a spine; a strong nuchal crest continuous with a dorsal crest, latter continuous to end of body, the scales growing smaller posteriorly; median dorsal caudal scales strongly keeled making a low caudal crest; dorsal and lateral scales keeled, the rows pointing upwards and backwards; caudal scale-rows directed backwards and slightly upwards; scales on venter smaller than dorsals, keeled, the keels parallel; subcaudal scales keeled, slightly smaller than lateral caudal scales.

Arms moderate, fourth finger longer than third; leg long, the leg brought forward toes reach tympanum; fourth toe distinctly longer than third; lamellae under digits with double keels, the keels becoming spinose anteriorly.

Color: This specimen, a large male, has head completely black except for cream stripe beginning somewhat back of nostril, covering supralabials and four scalerows; crossing tympanum it terminates on neck; sides of body dark olive the color covering arms and legs above; three rusty-brown spots on sides reaching up to dorsal crest; base of tail light olive, distal part dimly banded in dark olive and olive-gray; chin and throat deep black; venter light olive under limbs; basal part of tail dirty white.

Measurements in mm. (Nos. 1481 and 1485): Snout to vent, 132, 122; tail, 278, 233; width of head, 32, 30; length of head, 45, 40; snout to arm-insertion, 48, 47; axilla to groin, 63, 55; arm, 54, 56; leg, 86, 74.

Variation: A second specimen, a male, taken in the general vicinity of Kanchanaburi at the same time that the described specimen was taken, differs very markedly in color. However, the stripe on the head and neck and the three brown spots are in evidence. The area about the eye is black, as are the infralabials and part of the scales on chin and throat.

The head is bluish olive, and the anterior crest-scales are blue. The tail and part of the sides are fawn, while the venter is yellowish cream. The tail shows no trace of bands.

The highest part of the nuchal crest measures eleven millimeters; of the dorsal crest ten millimeters. The crest-scales in the second specimen measure nine and seven respectively. In all specimens the body is compressed.

Distribution: In Thailand I have taken specimens in the following provinces: Chiang Mai, Loei, Nong Khai, Udon Thani, Sara Buri, Khon Kaen, Kanchanaburi and Phet Buri.

It has been reported or collected in Nakhon Pathom, Rat Buri, and Chaiyaphum.

Taylor and Elbel have reported the species from Nakhon Si Thammarat but this I now believe to be an error despite the label the specimen bears.

Remarks: Courtship and egg laying are described in the introduction to the genus p. 884.

Calotes emma emma Gray

FIG. 53

Calotes emma Gray, Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 244 (type-locality *ex errore* "Afghanistan"); Blyth, Journ. Asiat. Soc. Bengal, vol. 22, 1853, pp. 413, 647; Günther, The reptiles of British India, 1864, p. 144; Theobald, Journ. Linn. Soc., vol. 10, Zoology, 1868, p. 38; Anderson, Anatomical and zoological researches and zoological results of the Yunnan Expeditions; Reptilia and Amphibia, 1879, p. 806; Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 324, pl. 25, fig. 1; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 137; Fascioli Malayenses, Zoology, vol. 1, 1903, p. 155; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 73; Flower, Proc. Zool. Soc. London, 1889, p. 641; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 54 ("commonly distributed but not found in Bangkok"); *ibid.*, no. 2, 1916, p. 155 (Narathiwat, Pattani, and Nakon Si Thammarat); The fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 195-197, fig. 55; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1099-1100 (Loei, Sakon Nakhon, Phattalung, and Nakhon Si Thammarat provinces).



FIG. 53.—*Calotes emma emma* Gray. No. 1341, La-Doo, Tin Mine Benang Stah, Yala. Actual snout-vent length, 99 mm.; tail, 261 mm.

Diagnosis: Scales on the sides of the body pointing backwards and upwards; a fold or pit on front of shoulder paved with minute black scales; dorsal scales larger than ventrals; a postorbital spine; 49-65 keeled scales round body; nuchal crest high in males.

Description of species (from No. 237 Coffee Camp, Na Bon Nakhon Si Thammarat): Head moderately large, its length about 1.5 times its width; rostral twice as wide as long bordered by two nasals and four postrostrals, outer ones separating nasals and rostral; scales on head unequal, keeled or rugose; two enlarged scales on frontal area; one or more enlarged supraocular scales; an elongated spine behind supraorbital edge, its length one half (or more) of diameter of orbit; a large spine on occipital region, surrounded by somewhat shorter spines, and another similar spine above tympanum; tympanum large superficial its length about half diameter of orbit; a sharp, slightly overhanging canthus rostralis; nine to eleven supralabials, eight or nine infralabials; mental narrowed behind, its labial border much smaller than that of rostral; scales on chin strongly mucronate; scarcely a trace of a gular sac; curving fold of skin in front of shoulder (sometimes angular) bordering a triangular "pit" or area covered with minute black scales; high nuchal crest of compressed scales with lower spines closely applied at their bases; this crest continues with a dorsal crest of much lower spines proportionately wider at their bases than those in the nuchal crest.

Scales on dorsum and side subequal; those on flanks a little smaller, strongly keeled and mucronate the scales pointing upwards and backwards except those low on flanks which point down and backwards; scales on dorsum equal to or larger than ventral scales; latter rather strongly mucronate; 46 scales about middle of body; tail swollen somewhat at base but scales not thickened; most other caudal scales keeled and mucronate.

Limbs well developed, fourth finger a little longer than second, with a row of 20 scales below, each with two spines; fourth toe longer than fourth finger, with 25 scales on undersurface, all with two forward-projecting short spines; hind leg reaches eye. Most scales with a small hairlike process emerging from posterior end of keel or just below the mucrone.

Color in life: Head dark red-brown tending to become reddish or pinkish posteriorly and on neck the red extending as far as 12th spine in crest; a black line from eye to above tympanum; lips and area in front of tympanum reddish; throat blackish mixed with red flecks; body yellowish brown to fawn with six transverse

marks, each tending to divide near mid-dorsal line and on middle of side. Tail banded with dark olive and dull gray-buff; some yellow coloring in groin; arms mottled with olive; legs strongly barred above with olive or olive-brown; venter, subcaudal area, and under-surface of limbs grayish, often with cream flecks.

Measurements in mm.: Snout to vent, 97; tail, 249; snout to arm-insertion, 37; axilla to groin, 47; width of head, 21.5; length of head, 32; arm, 49; leg, 75.

Distribution: The species occurs in peninsular Thailand. It has been taken in Pattani, Yala, Narathiwat, Trang, and Nakhon Si Thammarat.

Remarks: Females are less brilliantly colored, but the black shoulder spot, the lip area, and the transverse markings on back and tail are similar in the two sexes. Most young specimens of both sexes have the chin and neck displaying black longitudinal striations.

This species is common in southern Thailand especially in Trang and Nakhon Si Thammarat. In the month of November a period of much rain, I was able to find only two sizes of young, some with a snout-vent measurement of 32-48 mm., the smallest recently hatched; and another group that measured 65-74 mm., snout to vent. Only one adult female in half a month's collecting was seen. During the month of May almost all of the specimens seen in this area, and they were ubiquitous, were fully adult males and females. A large number could easily have been taken. One presumes that most adults find cover and keep in hiding during the rains.

Calotes emma alticristata Schmidt

Calotes alticristata Schmidt, Amer. Mus. Novitates, no. 175, 1925, p. 2; Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 482, fig. (type-locality, Yunnan-fu); M. Smith, The fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 197, under synonymy of *C. emma*.

Diagnosis: A form related to *Calotes emma emma* having a tubercular scale at end of the supraciliary edge, a longer and stronger nuchal crest and smaller dorsal scales; 10 to 15 more scales around the middle of body, and reaching a larger size (120 mm. snout to vent).

Description of species (from No. 36, from "near Whe Tat, northern Chiang Mai province"): Rostral twice as wide as high followed by two labials and five postrostral scales; nasal with nostril directed outward and somewhat backward, separated from rostral by a single scale; scales on snout forming an indistinct, inverted Y-shaped

group on snout and frontal area; some enlarged elongate scales in supraocular area; head scales variable in size, keeled or rugose; a tubercular scale back of supraciliary edge; canthus distinct, overhanging loreal region somewhat; tympanum large, superficial, slightly more than half diameter of orbit; a small spine in occipital region, and one above tympanum; nine or ten supralabials; ten infralabials; mental small, its labial border less than that of rostral, followed behind by two labials and two large postmentals, the latter separated by a narrow scale; each followed by two large chinshields, one behind the other. Gular scales much larger than ventrals; a high nuchal crest more or less continuous with dorsal crest; an angular fold in front of shoulder enclosing a black triangular spot; three or four enlarged scales between eye and upper edge of tympanum; body strongly compressed; scales on back in rows pointing backwards and upwards; lateral rows on flanks pointing backwards; third and fourth fingers equal; leg reaching to orbit; fourth toe with 29 transverse scales each with two spines or mucrones pointing down and somewhat forward; tail not or but slightly compressed; a slight gular pouch present.

Color: Light olive to gray-brown, top of head somewhat darker brown; a dark line in loreal region continued back of eye to above tympanum; upper and lower lip creamy white, the color extending back to below tympanum; chin and gular area grayish with black on skin between scales; throat blackish; dorsum with a series of six bands, more or less broken dorsolaterally by an indefinite light line, the bands each including a light spot on middle of back, and laterally forked to surround a lighter area. Tail banded gray and blackish.

Measurements in mm.: Snout to vent, 120; tail, 289; snout to arm-insertion, 49; axilla to groin, 60; width of head, 25; length of head, 36; arm, 50; leg, 83.

Distribution: Known in northern Thailand (Chiang Mai) and in southern China.

Genus APHANIOTUS Peters

Aphaniotus Peters, Monatsb. Akad. Wiss. Berlin, 1864, p. 385 (type of genus, *fuscus*).

A small agamid, snout to vent, 72 mm. or less; body compressed; tympanum hidden; dorsal scales small, intermixed with enlarged scales, some of which are in rows; a small nuchal crest; lacking femoral and preanal pores; a small gular pouch; toes long, fifth as

long or longer than first; arms and legs very long the leg reaching snout or beyond.

Two species are recognized of which only one, *A. fuscus*, enters our territory.

Aphaniotus fuscus (Peters)

FIG. 54

Atocryptis (Aphaniotus) fusca Peters, Monatsb. Akad. Wiss. Berlin, 1864, p. 385 (type-locality, "Malacca"?).

Aphaniotus fusca: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 274; Laidlaw, Proc. Zool. Soc. London, 1901, vol. 1, p. 307; Boulenger, Journ. Federated Malay States Mus., vol. 3, 1908, p. 65; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 64; de Rooij, The reptiles of the Indo-Australian Archipelago, Lacertilia, Chelonia, Emydosauria, 1915, p. 90; Swarder, Journ. Mal. Brit. Roy. Asiat. Soc., vol. 7, 1929, p. 327, text figs.; M. Smith, Bull. Raffles Mus., no. 3, 1930, p. 23 (Pattani).

Aphaniotis floweri Werner, Zool. Jahrb., Syst., vol. 13, 1900, p. 468.

Diagnosis: A median line of enlarged scales on snout; supra-orbital region with enlarged keeled or ridged scales; legs elongate, fourth toe reaching several millimeters beyond tip of snout; tympanum hidden, the area with one enlarged scale; snout about equal to length of eye; a row of enlarged keels on each side of midline, separated by seven scalerows.

Description of species (from EHT-HMS. No. 226, King George National Park, Kuala Tahan): Rostral vertical, a little more than three times as long as high; front face somewhat concave, with a small transverse ridge near mouth, in contact laterally with first supralabials, and bordered behind by seven scales, median largest; beginning with this scale, there follows a series of five scales in a line then two at terminus; nasal angular, elevated, craterlike, separated from rostral by one scale; an enlarged supranasal; canthus rostralis sharp; canthal scales continuous with supraciliary scales, 12 in all; supraocular region with six rows of enlarged scales those mesiad largest; occipital scales irregular, enlarged, keeled, the keels directed in various directions; eight supralabials each with a slight keel except first; mental triangular with a labial border equal to that of rostral; five distinguishable chinshields none in contact, first pair borders mental; a row of irregular scales from eye to above tympanum.

Scales on head generally pyramidal or conical; ten rows between the two largest series on supraocular areas; scales on body small, elevated, subimbricate; a row of enlarged keeled scales on each side of the back extending to level of legs. A second row indicated anteriorly on side of neck and shoulders; scales on chin and throat

smaller than scales on venter; ventrals imbricating, strongly keeled, the keels terminating in elevated mucrones; scales on arms, legs and tail enlarged, keeled (sometimes mucronate), imbricate; 27 scales under longest toe (counting those on free portion); fifth toe longer than first, second, or third; leg reaching beyond tip of

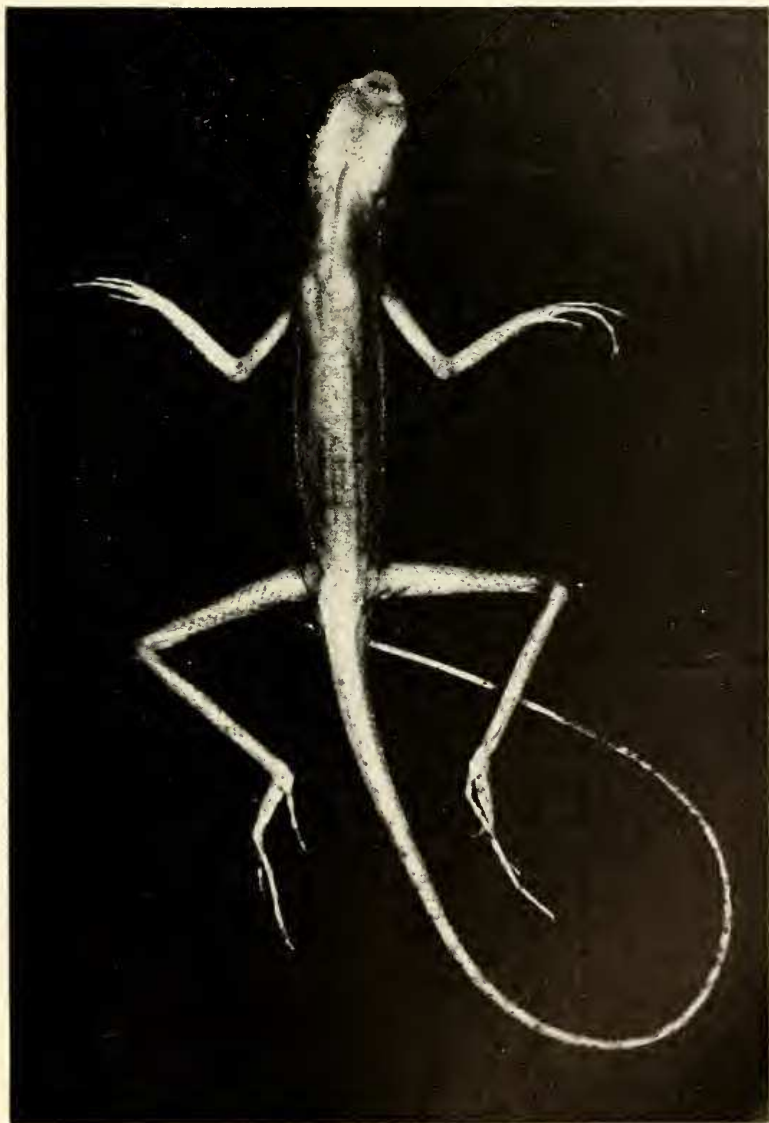


FIG. 54.—*Aphaniotus fuscus* Peters. EHT-HMS No. 226, King George National Park, Pahang Malaya. Actual length, 216 mm.

snout. A small nuchal crest; dorsal crest scarcely distinguishable; tail cylindrical, long and slender.

Color: Head olive-brown above, lighter brown in occipital region; sides of head and chin with a suggestion of bluish-green color; gular pouch black; back nearly uniform dark brown. Arms darker on upper part, lighter on forearm with or without some bands; leg similar, lower leg lighter than upper part with some suggestion of banding; tail with narrow darker and lighter bands seemingly not normally symmetrical; inside of mouth blue.

Measurements in mm.: Snout to vent, 63; tail, 153; width of head, 13; length of head, 16; snout to arm-insertion, 26; axilla to groin, 30.5; arm, 38; leg, 65.

Distribution: In Thailand the species has been taken only in Pattani. I saw two specimens but was unable to capture them at a place near La Doo Tin Mine, Benang Stah, Yala. When I first saw them at some distance I mistook them for young specimens of *Calotes*.

Outside of Thailand the species is known in Malaya, Borneo and the Natuna Islands.

Genus *LEIOLEPIS* Cuvier

Leiolepis Cuvier, Règne Animal, 2nd Ed., 1829, p. 37 (type of genus, *guttatus*).

Diagnosis: Body rather strongly depressed; no crests; dorsal scales usually small, juxtaposed, conical or pyramidal, and more or less keeled; no distinct gular pouch, but one or two transverse gular folds; femoral pores in both sexes; tail long, somewhat thickened at base, the scales nearly uniform; ventral scales imbricate, subquad-rangular forming transverse rows.

Two subspecies are recognized in Thailand: *Leiolepis belliana belliana*, and *L. b. rubritaeniata*. A third form *L. b. guttatus* may also occur in the extreme eastern part of the country.

KEY TO THREE SUBSPECIES OF *LEIOLEPIS BELLIANA*

1. The black edges of spots on back and dorsolateral area form a definite reticulum and lack almost completely a longitudinal or linear arrangement; nine to twelve scales across middle of undersurface of tibia; trace of a lateral stripe above and anterior to leg-insertion, *b. rubritaeniata*
 No dark reticulum on dorsum; lines or rows of spots present. 2
2. Twelve or fourteen scales across undersurface of tibia at middle; ventral scales about as broad as two dorsal scales . . . *b. guttulata*
 Seven to twelve scales across undersurface of tibia at middle; ventral scales as broad as three or four dorsal scales *b. belliana*

Leiolepis belliana (Gray)

Uromastix belliana Gray, Zool. Journ., vol. 3, 1827, p. 220 (type-locality, Penang, Malaya, based on Hardwicke's drawing); Illustrations of Indian Zoology, vol. 2, 1834, pl. 72.

Leiolepis guttata: Günther, Reptiles of British India, 1864, p. 154.

Leiolepis belliana: Gray, Catalogue of the Lizards in the British Museum, 1845, p. 263.

Leiolepis bellii: Cantor Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 41; Swinhoe, Proc. Zool. Soc. London, 1870, p. 240; Boulenger, Catalogue of the lizards of the British Museum, vol. 1, 1885, p. 403; Fasciculi Malayenses, vol. 1; Zoology, 1903, p. 155, pl. 10, fig. 2 (Young); Ann. Mus. Civ. Genova, ser. 2, vol. 5, 1887, p. 477; Flower, Proc. Zool. Soc. London, 1899, p. 642.

Leiolepis belliana: Ridley, Journ. Straits Branch Asiat. Soc. no. 32, 1889, p. 191; Boulenger, The fauna of British India . . . 1890, p. 156; Annandale, Proc. Zool. Soc. London, 1900, p. 858; Rec. Ind. Mus., vol. 7, 1912, p. 90; Laidlaw, Proc. Zool. Soc. London, 1901, p. 308; Boulenger, Fauna of the Malay Peninsula . . . 1912, pp. 73-74; Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 4, Dec. 1915, p. 242; *idem.*, vol. 2, no. 1, 1916, p. 54, no. 2, 1916, p. 155; de Rooij, Reptiles of the Indo-Australian archipelago, vol. 1, 1915, p. 136, fig.; Mell, Arch. Naturgesch. Berlin, Bd. 88, 1922, p. 112; Schmidt, Bull. Amer. Mus. Nat. Hist., 54, 1927, p. 416; Copeia, 1928, p. 80.

Leiolepis belliana belliana: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 238-240, fig. 61a and b; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, no. 2, 1958, pp. 1100-1101 (Loei, Kanchanaburi and Sisaket, provinces); Mertens, Senck. Biol., vol. 42, No. 5/6, 1961, pp. 507-510.

Uromastix reevesii Gray, in Griffith's, Cuvier's Animal Kingdom, vol. 9, 1931, Suppl. p. 62 (type-locality, China).

Leiolepis reevesii: Theobald, Journ. Linn. Soc., vol. 10, Zoology, no. 41, May 30, 1868, pp. 34-35 (Pegu, Tenasserim, Burma).

Uromastix maculatus Gray, in Griffith's, Cuvier's Animal Kingdom, vol. 9, 1931, Suppl. p. 62 (type-locality ?).

Leiolepis belliana belliana (Gray)

FIG. 55

Diagnosis: Body depressed, lacking a dorsal crest; no spines on head; lateral skin expansible; scales small, mostly keeled; a strong transverse gular fold; tympanum large, superficial; long series of femoral pores separated in pubic region. Tail thickened at base, somewhat depressed. Spotted or lined above, the sides with alternating bars of black and orange.

Description of subspecies (from No. 34399, Yahling, Pattani): Rostral twice as wide as high, bordered by two labials and six smooth postrostrals, two median largest, followed by five strongly keeled scales, outer ones in contact with nasals; nostril in posterior part of nasal, directed somewhat outwards and backwards; canthals not or scarcely differentiated; anterior supraciliary scales overlapping strongly, ridged or keeled; a row of subocular scales, the ones below eye much elongated, more than half length of eye;

scales on snout, frontal, and interorbital areas somewhat enlarged; supraorbital scales and those on occiput very small; no crests; nasal separated from labials by at least three rows of scales; from rostral by one scale; ten or eleven supralabials, last longest; nine infralabials; mental smaller than rostral, partly divided transversely, followed by a pair of postmentals broadly in contact, each of these followed by diverging series of scales, separated from infralabials but parallel to them; tympanum large, slightly sunken, its diameter equal to length of eye-opening; sides of neck plicate with a distinct transverse nuchal fold preceded by another rather indefinite fold; sides of body expansible; all dorsal scales small, keeled; ventrals much larger, about 40 longitudinal rows at middle of body; scales under tibia in nine or ten rows at middle, more than double size of scales under thigh; a series of 18-17 femoral pores separated mesially by 17 pubic scales; caudal scales strongly keeled, in nearly straight transverse rows, growing gradually larger distally; basal portion depressed, widened, then rather suddenly narrowing, terminating in a fine point. Third and fourth fingers subequal, with 20 subdigital scales, each scale with two or three keels; fourth toe with 34 subdigital scales each with two keels and scarcely a suggestion of a third; leg reaches tympanum; at base of third toe (not fifth as stated in Smith, 1935) there are three or four scales with enlarged triangular "spurs."

Color in life: Head olive with darker areas on side; dorsum blackish olive above with black-edged canary-yellow spots usually arranged in lines or fused together to form five lines of the same color; on flanks a series of black and orange bars, black widest dorsolaterally, terminating bluntly or in a point ventrolaterally; throat reticulated black and cream; venter and breast yellowish orange, laterally with dark lines or mottling on breast and very small light olive spots, less obvious on venter; tail yellow-olive at base with numerous spots becoming yellow-brown distally; subcaudal region yellowish; limbs speckled with yellow and with a dark bordered yellow stripe posteriorly on thigh.

Measurements in mm.: Snout to vent, 114; tail, 238; snout to arm-insertion, 42.5; axilla to groin, 54; width of head, 20; length of head, 27; arm, 43; leg, 83.

Variation: A specimen, KUMNH No. 40106 from Srisaget (= ?Sisaket). This specimen measures 139 mm. snout to vent, the tail broken. The specimen a female has retained a color pattern usually regarded as juvenile. The body is blackish above and dorso-



FIG. 55.—*Leiolepis belliana belliana* Gray. No. 1358, Na Pradoo, near base of Bukit Besar, Pattani province. Actual total length, 223 mm.

laterally. A dorsolateral whitish gray stripe extends from the eye to base of tail, the color not solid but each of the scales involved is pyramidal in shape and the anterior face has a black spot partially edged with white. The minute beadlike scales about the base of the pyramids are bluish white. A similarly colored median line bifurcates on neck and runs forward to occiput, partially broken. A gray line from eye above tympanum turns downward and backward, terminating a centimeter anterior to arm-insertion; a diagonal broad blackish stripe from eye to near arm-insertion; a gray lateral stripe broken anteriorly behind and above arm-insertion and extending back to near groin. Scattered gray-white dots on ground color; on arms and legs, throat, and to some extent chin, blackish with fine white dots or marks; vertical bars not indicated on sides; venter and underside of tail unspotted.

Distribution: The subspecies occupies territory probably throughout the whole of peninsular and southern central Thailand. Specimens have been taken in Pattani, Kanchanaburi, Raj Buri, and ?Sisaket.

Remarks: These seemingly prefer sandy soils in which they burrow, and are often common in areas near seashores but not on the shore itself. They move with amazing speed, and are said to sail actually as they take off from a bank. This seemingly is accomplished by the spreading of the lateral skin and increasing the surface. The young hatch from eggs.

Leiolepis belliana rubritaeniata Mertens

FIG. 56

Leiolepis belliana rubritaeniata Mertens, Senck. biol., vol. 42, no. 5/6, pp. 508-509, pl. 28, fig. 2, type-locality Pakjong (Pakchong), 160 km. nordöstlich Bangkok an der Strasse zwischen Bangkok und Korat) Thailand, province of Sara Buri or Nakhon Ratchasima.

Diagnosis: Similar to *L. belliana belliana* in general body form but differs in having the rounded or oval black-edged spots more numerous the black edges forming a distinct dorsal reticulation.

Description of subspecies: (from No. 33800 near Chiang Mai, Chiang Mai province): Rostral nearly three times as wide as high; bordered by two labials and seven somewhat enlarged postrostral scales; scales on snout and interorbital area larger, distinctly keeled, continued back to occiput; seven scalerows between supraocular areas which are largely covered with small equal keeled scales; nasal large separated from rostral by three or two scalerows; can-



FIG. 56.—*Leiolepis belliana rubritaeniata* Mertens. No. 33804, Chiang Mai (city), Chiang Mai province. Actual snout-vent length, 126 mm.; total length, 402 mm.

thals enlarged, elongated, beginning behind nostrils, continuing back to posterior level of supraciliary edge, ridged and keeled in more than a single series. A subocular series of keeled scales begins near nasal, largest of series directly below eye; nine supralabials; eight or nine infralabials distinctly larger than supralabials; mental with a labial border little more than half length of labial border of rostral; mental bordered behind by a pair of chinshields separated from infralabials, which are first of a series of enlarged sublabials, all separated from labials by one, two, or three rows of small scales; scales on chin and throat rounded, moundlike, juxtaposed; two transverse bands of small scales across ventral side of neck, separated by a transverse band of imbricate scales.

Occipital head-scales small; dorsal scales variable, small, tubercular, conical, pyramidal, all juxtaposed, and tending to be arranged in transverse series. Ventral scales much larger, imbricate, subquadrangular, forming transverse series; 16-15 femoral pores present on undersurface of thigh scales on tail in transverse series those below largest, all keeled; terminal two and one-third inches regenerated; scales not arranged in transverse rows; ten or eleven enlarged scalerows on undersurface at middle. Tympanum large, equally as wide as eye-opening; skinfolds on side of neck; loose skin on side of posterior part of abdomen can be spread by action of ribs.

Color and markings: Above with numerous bluish-gray oval spots, their black edges forming a reticulum; an irregular orange lateral stripe almost segmented by eight black diagonal lateral bars. Chin gray, breast with dim darker markings; subcaudal region whitish; reproduced tail pinkish; arms and legs mottled in darker or with numerous light spots; tail with small light dots on dorsal surface.

Measurements in mm.: Total length, 296; snout to vent, 134; tail, 162; width of head, 13; length of head, 32; snout to arm-insertion, 54; axilla to groin, 63; arm, 45; leg, 85.

Variation: The type as figured by Dr. Mertens, differs in having broad black bands on sides separated by narrow orange bands in the region in front of the arm-insertion and in the postaxillary area; these black bars presumably are not on the latter half of body.

Distribution: The subspecies occupies territory in the western and central parts of northern Thailand. Specimens are known from Chiang Mai, Sara Buri and Nakhon Ratchisima provinces.

Physignathus Cuvier

Physignathus Cuvier, Règne Animal, 2nd Ed., vol. 2, 1829, p. 41 (type *Physignathus cocincinus*).

Body more or less compressed; a dorsal, nuchal, and a caudal crest; no distinct gular sac; tympanum partly or completely distinct, superficial; tail compressed, or rounded in some species; femoral pores present.

This genus is chiefly Australian and Papuanian. Only a single Asiatic species is known, this occurring in Thailand and Indo-China. The species has not been taken in the Malay Peninsula.

Physignathus cocincinus Cuvier

Physignathus cocincinus Cuvier, Règne Animal, 2nd Ed., vol. 2, 1829, p. 41 (type-locality, Cochin China); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 6, 1923, p. 50.

Physignathus cochinchinensis: Günther, Reptiles of British India, 1864, p. 153; Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 1, 1885, p. 400; Tirant, Notes sur les Reptiles et les Batraciens de la Cochinchine et du Cambodge; Saigon, 1885, p. 93; Angel, Bull. Mus. Hist. Nat. Paris, 1928, p. 446; Schmidt, Copeia, 1928, p. 78.

Dilophrys mentager Günther, Proc. Zool. Soc. London, 1861, p. 188 (type-locality Chantabun [= Chanthaburi Province], Thailand).

Physignathus mentager: Günther, Reptiles of British India, 1864, p. 153, pl. 15; Boulenger, Catalogue of the lizards in the British Museum, vol. 1, 1885, p. 400; Tirant, Notes sur les reptiles et les batraciens de la Cochinchine et du Cambodge, 1885, p. 93; Flower, Proc. Zool. Soc. London, 1899, p. 641; M. Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, 1915, p. 241; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 54; Mell, Arch. Naturg. Berlin, Bd. 88, 1922, p. 112; M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 236-238; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, p. 1101 (Sakhon Nakhon).

Diagnosis: Body compressed; nuchal and dorsal crests continuous, caudal crest separated from dorsal by a hiatus; two diverging series of enlarged scales on lower jaw, larger than infralabials; a few scattered enlarged scales behind jaw angle; a nuchal fold; femoral pores in short series; tail strongly compressed; tympanum partly scaled.

Description of species: Snout longer than orbit. Rostral a little wider than high, bordered behind by two supralabials and eight postrostrals; nasals rather small, surrounded by a ring of slightly elevated scales separated from rostral by three scales, from labials by five rows of scales; scales on snout larger than other head scales, about ten rows separating nasals; those on supraocular and occipital regions smaller except for a curved row of enlarged scales defining supraocular areas; a depressed area on anterior part of occiput and

in interorbital region. Cheeks swollen in males; canthal and supra-ciliary edge rather blunt; a fold across throat; scales in lower part of temporal region, the subocular and loreal areas, larger than those on occiput, the largest ones form a row bordering supralabials; a row of four or five enlarged suboculars; twelve supralabials; eleven infralabials; labial border of mental larger than that of rostral; first pair of chinshields the larger, forming a median suture, each heading a row of eight or nine much-enlarged scales, the rows diverging, two or three of the series touching infralabials scales; scales of chin and throat differ in size, those on sides of throat extending to behind jaw angles, with some enlarged tubercles, the two largest on each side, white in color.

Most of the scales on dorsal surface of head and body juxtaposed, tubercular, ridged, or bluntly keeled; a denticulated nuchal crest arising from a fold of skin continuous with dorsal crest; latter extending to level of leg-insertions, the scales triangular, separated; one or more finely-pointed scales at base of each of nuchals no larger than dorsals; tail with a denticulate caudal crest, the scales triangular touching one another at their bases, terminating at end of basal fourth and followed to tip of tail by two scalerows, with a depression between; lateral scales keeled, small, growing larger ventrally and distally; subcaudal scales enlarged, strongly keeled, ten or twelve rows proximally, usually four distally. Scales on venter imbricate, larger than dorsal scales, more or less keeled and bearing a terminal pit; the scales on limbs imbricate or subimbricate, variable in size, some distally keeled, others tuberculate; third and fourth fingers subequal with 22 lamellae on underside, each with two keels; fourth toe much the longest, with two or three rows of unequal irregular scales below, about 34 scales in each row; scales bordering outer edge of digit with a high compressed keel pointing down; scales at base of third toe especially modified; femoral pore-scales large, four on right side, five on left, the pore situated on posterior edge of scale; tympanum small, much of its surface scaled. The leg reaches almost to nostril.

Color in life: Above, head and body light greenish olive, the enlarged scales on chin bluish bordered with rose-lavender; venter and underside of limbs green with a wash of greenish yellow; anal region and underside of tail yellowish becoming grayish distally; tail gray-green with a series of 12 buff-brown bands beginning about 60 mm. behind vent and continuing to tip of tail, becoming wider and tending to encircle tail distally; the pore-scales cream; underside of hand and foot dirty yellowish white.

Measurements and data on *Physignathus cocincinus*

NUMBER*	746	747	813	748	31728†
Sex.....	♂	♂	?	♀	?
Snout to vent.....	198	171	160	158	135
Tail length.....	532	482	450	.....	351
Total length.....	730	653	610	.....	486
Head length.....	67	54	45	45	36
Head width.....	48	33	31	28	25
Head depth.....	37	31	27	25	25
Arm.....	91	82	75	71	61
Supralabials.....	14-14	13-12	14-14	13-13	.....
Infralabials.....	12-13	10-12	12-13	10-10	.....
Sublabials.....	11-12	11-11	12-14	11-12	.....
Femoral pores.....	8-7	6-7	8-8	7-7	.....
Scales under 4th toe.....	40	36	36-38	34	.....

* From Sanoi River Ubon.

† Sakhon Nakhon.

Variation: The males are larger than females and the crests on neck, dorsum and tail are very much better developed, the individual scales, compressed and longitudinally striated are from 10-12 millimeters in height. There is no complete hiatus between nuchal and dorsal crests but the crest-scales are much reduced in size where the crests meet. There is a distinct break between dorsal and caudal crests. The caudal crest is largely confined to the basal third of the tail, beyond which there are two ridges formed by two scale-rows, which terminate at tip. The femoral pores are better developed and functional in males. (In females the pore may be indicated only by a notch in the pore-scale.) The male reaches a snout-vent length of 250 millimeters with a tail measuring 650. None of my specimens are so large. A male from Sanoi River, Ubon, measures 730 millimeters in total length.

Distribution: In Thailand specimens have been taken in Sakon Nakhon, Ubon, on the stream forming a boundary between Sara Buri and Nakhon Ratchasima, Koh Kut Island, and Klong Menao, Trat (Trad) province. It is probably widely distributed in eastern and southeastern Thailand.

Elsewhere the species is known in Indo-China.

Remarks: The usual type of coloration shows three to five narrow oblique light stripes on each side especially in the young. These may be bluish in life. The underside of the body may be nearly white with patches of blue.

It is said to be an insectivorous species rather than a leaf eating one.

FAMILY VARANIDAE

This family comprises the largest living lizards, those on the island of Komodo, known as Komodo dragons, reaching a length in excess of three meters. The range of the family, which consists of the single living genus *Varanus*, covers almost all of the continent of Africa, Asia south of the Himalayas (including the Arabian Peninsula); the Indo-Australian Archipelago, the Philippines and Australia. They are absent from Madagascar, Tasmania and New Zealand. The family was formerly present in the Western Hemisphere. They appear in the Eocene beds of Wyoming. These constitute a different subfamily, the Saniwinae with the genus *Saniwa*, and possibly also the genera *Paleosaniwa* and *Parasaniwa*.

These animals are catholic in their taste for food and seemingly are willing to eat almost any creature they can bring down. They appear to be very fond of carrion. In Mindanao, Philippines, shallow graves are sometimes opened by these animals at night and the corpses partially consumed. The deed is usually blamed on some forest-devil. The graves of certain peoples living along the Mindanao coasts are covered with masses of coral often three or four feet in thickness. I am informed that the coral discourages these devils from molesting the graves.

Genus VARANUS Merrem

Monitor Lichtenstein, Zool. Mus. Univ. Berlin, ed. 2, 1818, p. 66 (*non* Blainville 1816).

Varanus Merrem, Tentamen systematis amphibiorum. Marburg, 1820, p. 58 (type of genus, *Lacerta varia* Shaw).

Diagnosis: Very large lizards, reaching 1 to 3 m. in length; head covered with small juxtaposed scales, body with even smaller scales and, except in very young specimens, each scale surrounded by a rosette of tiny granular scales; tongue very long, slender, deeply bifid, retractile into a sheath; ventrals quadrangular, arranged transversely; a single pair of preanal pores present, their openings just in front of vent; small pits present on scales, those before vent and on thighs somewhat different from others. Osteoderms present. Tail elongate, not fragile; pupil round; eyelid well developed. Five species are represented in Thailand.

KEY TO THAI SPECIES OF VARANUS

- | | |
|--|---|
| 1. Enlarged scales on dorsal surface of neck rather widely spaced; nostril oblique, twice as far from end of snout as from orbit | 2 |
| Scales on neck not widely spaced nor especially enlarged; distance of nostril from tip of snout variable, but nearer to end of snout than to orbit | 3 |

2. Enlarged flat neck-scales arranged in 10-12 longitudinal rows, the posterior ones keeled; dorsal scales strongly keeled. Blackish above, neck and anterior part of body yellowish with three black longitudinal stripes on head and neck; two black bands across shoulders,
rudicollis

Enlarged flat neck-scales not arranged in distinct rows; dorsal scales slightly enlarged, strongly keeled; snout depressed at end; head light brown to yellowish-brown with a pair of black streaks from eye joining a transverse dark band on neck; back with four rather distinct broad darker bands narrowly separated by light dotted bands, except one on neck wider and more distinct . . . *dumerilii dumerilii*

3. Snout depressed at end, half as long as head; nostril rounded or oval, twice as far from orbit as from tip of snout. Thai specimens usually with five or six transverse bands of yellow ocellated spots across back; head banded anteriorly with black, ventrals keeled,
salvator salvator

Snout not depressed at end; nostril not twice as far from orbit as from end of snout; ventral scales smooth 4

4. Nostril a little nearer to end of snout than to orbit; supraocular scales only slightly enlarged; olive or yellowish brown above with irregular darker markings which may form dark crossbars; a blackish temporal streak, below yellow with more or less distinct crossbars,
flavescens

Nostril much nearer end of snout than to orbit; four or five transversely enlarged supraoculars; nuchal scales not keeled; other scales keeled on body; olive-black on body with numerous small yellow spots not forming well-defined crossbars; a dark temporal stripe from eye merging with dark marks on neck *bengalensis nebulosus*

Varanus rudicollis (Gray)

FIG. 57

Varanus rudicollis Gray, Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 10 (type-locality, Philippine Islands).

Varanus rudicollis: Boulenger, Catalogue of the lizards in the British Museum, 2nd Ed., vol. 2, 1885, p. 313 (Sarawak, Borneo); Flower, Proc. Zool. Soc. London, 1896, p. 873 (Malay Peninsula); *ibid.*, 1899, p. 643; Hanitsch, Checklist of the reptiles and amphibians in Raffles Museum, 1901, p. 2; Laidlaw, Proc. Zool. Soc. London, 1901, p. 310 (Perak); Boulenger, Fasciculi Malayenses, Zoology, vol. 1, 1903, p. 174; Barbour, Mem. Mus. Comp. Zool., vol. 44, p. 183; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 78 (Trang, first report from Thailand); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, No. 1, 1916, p. 55 (Trang, Thailand); Chasen and Smedley, Journ. Mal. British Asiat. Soc., vol. 5, p. 352.

V[*aranus*] (*Dendrovaranus*) *rudicollis*: Mertens, Abh. Senckenb. Naturf. Gesel. Abh. 462, 465, 466 (all continuous pagination), 1942 pp. 195, 360-363, pl. 12, fig. 56, 57, pl. 13, fig. 65, pl. 15, fig. 94; Senckenbergiana biologica, vol. 40, No. 5 6, 1959, p. 224.

Varanus scutigerulus Barbour, Proc. New England Zool. Club, vol. 13, p. 1 (type-locality, Kampong Ulu, Sarawak N. Borneo).

Varanus (*Varanus*) *salvator scutigerulus*: Mertens, Senckenbergiana biol., vol. 40, No. 5 & 6, 1959, p. 259.



FIG. 57.—*Varanus rudicollis* (Gray). From Mertens, Abh. senckenb. naturf. p. 98, pl. 12, Ges., 462, 1942, p. 98. Tafel 12, fig. 56.

Diagnosis: Nostril oblique, distance between eye and nostril half that between nostril and tip of snout; three to six transversely widened supraocular scales; large prominent scales on nuchal region, strongly keeled, forming ten to twelve longitudinal series; ventral scales keeled; body with yellow transverse bands or rows of ocelli; sides of neck yellow (reddish in life).

Description of species (from No. 666 near Ranong, Ranong province, Thailand): Snout rather pointed, elongated, somewhat less than half length of head; nostril one half as far from eye as from tip of snout; distance between eye and ear (15 mm.), greater than distance between eye and nostril; canthus rostralis distinct; a longitudinal depression or groove on snout and a groove on lower jaw; rostral small, followed by two scales; a series of transversely widened supraoculars, anterior ones smallest; scales in temporal region very small; tympanum large, superficial, the posterior part concealed by a slight skinfold; a small fold from jaw angle to shoulder more or less continuous with a slight fold from shoulder to groin.

Scales on neck compressed forming high keels, arranged in ten or twelve series gradually merging into the smaller lateral nuchal series; scales on limbs and dorsum small, somewhat larger on back than on sides and flanks; ventrals strongly keeled; tail compressed with a double-keeled low median crest; scales on tail arranged in nearly regular transverse series, equal-sized proximally, the ventral subcaudals becoming larger distally; a pair of preanal pores in male, widely separated.

Eye-opening nearly of same size as tympanum; teeth compressed, pointed.

Color: Top of head generally brownish or olive-brown, most scales having a darker center; scales on snout a little larger than those in frontal and occipital regions; a pair of black stripes begin behind eyes, that extend back as far as a black transverse band in front of shoulders; area between bands on dorsal surface brownish; sides of neck, below longitudinal stripes, and underside, yellowish (reddish in life), with some black areas on sides of throat and under chin; an irregular yellowish bar across shoulders followed by a black irregular bar with extensions onto arms; this followed by a broad yellow band reaching to slight lateral fold; across middle of back a double row of ocelli preceded and followed by indefinite dark bands; next follows a row of single ocelli; a faint yellowish band between hind legs; arms and legs with some yellow spots; a distinct yellow spot at base of each claw dorsally; venter with in-

definite yellowish bars separated by a darker area. Tail generally olive-brown, with two basal bands discernible; yellowish in sub-caudal region.

Measurements in mm.: Snout to vent, 306; tail, 426; total, 732; snout to arm-insertion, 140; axilla to groin, 114; head length, 68; head width, 26.5; arm, 103; leg, 160. (From a mounted specimen in Chulalongkorn; the measurements are not accurate but close approximations).

Distribution: The species is known from the provinces of Ranong and Trang, in Thailand. It doubtless occurs in other southern peninsular provinces but is regarded as a rare species.

Outside of Thailand the species occurs in Southern Burma, May-laya, and islands of Sumatra, Borneo, Banka, reaching as far as the Philippines. There is a doubtful record for Celebes.

Remarks: The description is drawn from a mounted specimen. It was taken near Ranong in the province of the same name. It is perhaps the most northern locality record of this species; Boulenger (1912) has reported its presence in Trang province previously.

The species is conspicuous in having the large nuchal scales with high compressed keels, arranged more or less in series, and cannot be mistaken for another species.

Boulenger's 1912 description of the color markings differs somewhat: "Blackish above, the neck and anterior part of the body yellowish, the former with three black longitudinal streaks, the latter with two broad transverse black bands; hinder part of back and flanks with yellowish ocelli; limbs with yellowish spots; lower parts with black reticulations." It is said to be a jungle form.

Varanus dumerilii (Schlegel)

Monitor dumerilii Schlegel, *Abbildungen amphibiorum*, 1839, p. 78 (type-locality Bandjermasin, S. Borneo).

Two subspecies are recognized. The typical form only is known from peninsular Thailand.

Varanus dumerilii dumerilii (Schlegel)

Monitor dumerilii Schlegel, *Abbildungen neuer oder unvollständig bekannter Amphibien* . . . 1839, p. 78 (type-locality, Bandjermasin, Borneo); Günther, *Proc. Zool. Soc. London*, 1872, p. 588.

Varanus macrolepis Blanford, *Journ. Asiat. Soc. Bengal*, vol. 50, pt. 2, p. 239, pl. 16 (type-locality, Tenasserim, Burma).

Empagusia flavescens: Blyth, *Proc. Asiat. Soc. Bengal*, vol. 22, p. 412 (Mergui).

Varanus dumerilii Bleeker, *Nat. Tijdschr. Ned. Ind.*, vol. 16, 1858, p. 188 (Borneo); Boulenger, *Catalogue of the lizards in the British Museum*, vol. 2, 1885, p. 312; *The fauna of British India* . . . Reptilia and Batrachia,

1890, p. 165; Proc. Zool. Soc. London, 1890, p. 33; Werner, Verh. Zool. bot. Ges. Wien., vol. 46, p. 12; Annandale, Journ. Asiat. Soc. Bengal, new ser., vol. 1, 1905, p. 90; Barbour, Mem. Mus. Comp. Zool., 1912, vol. 44, p. 183 (Burma, Borneo, Sumatra); Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, pp. 77-78; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 54; Journ. Federated Malay States Mus., vol. 10, 1922, p. 269 (Pahang, Malaya); The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 405-406.

V[aranus] (Tectovaranus) dumerilii dumerilii: Mertens, Abh. Senckenb. Naturf. Ges., Abh. 462, 465, 466, 1942, pp. 263-264, pl. 11, fig. 63; pl. 17, fig. 117; pl. 22, figs. 150, 151; pl. 27, fig. 211; pl. 31, fig. 248, 249; pl. 32, fig. 264; pl. 34, fig. 292.

Diagnosis: Nostril an oblique slit, twice as near orbit as to end of snout; scales in nuchal region two to three times size of scales on top of head; canthus rostralis distinct; tail compressed with a double-toothed crest. Two black dorsolateral head-bands join a black band about neck, the ring followed by a narrower cream-band. Body blackish or dark brown with three narrow dotted or continuous cream-bands.

Description of species (from half-grown specimen Khao Chong, Trang *):

Snout somewhat convex, depressed at tip, its length two and one-half to three times its height; nostril situated twice as close to eye as to tip of snout; distance between ear and orbit greater than distance between eye and nostril; posterior edge of tympanum less superficial than front edge; rostral small; 15 supralabials followed by five scales bordered internally by small concealed granules; 18 infralabials followed by five scales bordered internally with granules; mental small its labial border not or scarcely larger than that of rostral, bordered behind by two scales that are the first of two scale series separated by a groove. Rostral followed by two scales, and these by three scales all larger than surrounding scales; five scalerows of unequal size in interocular region; five unequal rows above each eye, the scales not conspicuously widened; occipital scales about equal to those of frontal area; none of head scales keeled, anterior ones with numerous "pits."

Dorsal scales on neck two to three times size of head scales all strongly but bluntly keeled (except a few anteriorly) the enlarged scales extending back nearly to level of arm-insertion; scales on dorsum rather large but smaller than those in nuchal region, varying a little in size, all rather sharply keeled, smallest scales occurring low on sides, all arranged in more or less distinct transverse rows; ventral scales smaller than lateral body scales, arranged in about 65 transverse rows from axilla to groin; smooth scales on exposed

* Specimen from Forestry Department, collected by Nai Dumrong Chaiglom, later presented to Chulalongkorn University.

parts of limbs; tail strongly compressed, the keeled scales arranged in transverse rows or whorls; upper scales on tail in two denticulate rows highest at base of tail; lateral caudal scales smaller than ventral caudal scales. Limbs pentadactyl third and fourth fingers equal; rows of flat scales under digits; fourth toe longest, with 17 transverse rows of scales on under surface.

Color: Brownish to brownish black with five more or less regular cream to yellow transverse bands, first widest, between or slightly in advance of arms, fifth between legs; throat and neck yellowish. A pair of dorsolateral blackish stripes on head that join a blackish transverse nuchal band. Arms and legs with yellow spots and flecks; yellow band preceding groin, somewhat ocellate; base of tail with indefinite yellow bands, indistinct or absent distally; venter banded with black bands and rows of ocellated yellow spots.

Measurements in mm. (from M. Smith, 1935): Snout to vent, 500; tail, 750; total, 1250 (largest specimen).

Variation: The young are nearly black or brownish black and markings are very distinct. The upper side of the head is bright yellow (perhaps reddish in life). Mertens 1942 has separated *d. dumerilii* from *d. heteropholes* on the character of the scales. In the former scales at base of the tail on neck and back are more or less similar; in the latter the scales on tail vary between small and large, while scales on neck and back are distinctly dissimilar.

Distribution: In Thailand the species has been taken in Trang province near the Forest Experimental Station at Khao Chong.

It is known outside of Thailand in Tenasserim, Malaya, Sumatra, Borneo, and a few smaller islands.

Varanus salvator (Laurenti)

Stellio salvator Laurenti, Specimen medicum exhibens synopsis reptilium emendatam (type locality "America" *ex errore*).

Several subspecies of this widely distributed species are recognized, only one of which, the typical one, occurs in Thailand.

Varanus salvator salvator (Laurenti)

FIG. 58

Stellio salvator Laurenti, Specimen medicum, exhibens synopsis reptilium emendatam . . . 1786, p. 56 (based on Seba, Thesaurus, vol. 2, pl. 88, fig. 2 type locality, America *ex errore*).

Varanus salvator: Cantor, Journ. Asiat. Soc. Bengal, vol. 16, pt. 2, 1847, p. 635, published separately as, Catalogue of reptiles inhabiting the Malayan peninsula and Islands, collected or observed by Theodore Cantor, Esq., M. D., p. 29; Boulenger, Catalogue of the lizards in the British Museum (Natural History) Ed. 2, vol. 2, 1885, p. 314; The fauna of British India . . .

Reptilia and Batrachia, 1890, p. 166; Laidlaw, Proc. Zool. Soc. London, 1901, p. 309; M. Smith, *ibid.*, vol. 2, pt. 2, Dec. 1916, p. 158 (Nakhon Si Thammarat and Pattani); Journ. Bombay Nat. Hist. Soc., vol. 35, 1932, p. 616; Journ. Nat. Hist. Soc. Siam, vol. 2, pt. 1, June 1916, p. 55 ("Common about Bangkok"); Flower, Proc. Zool. Soc. London, 1896, p. 873. Boulenger, Fasciculi Malayenses, vol. 1, Zoology, 1903, p. 187.

Varanus salvator salvator: Mertens, Senckenb. Naturf. Ges., Abh. no. 466, 1942, pp. 245-253; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1042, 1101.

Diagnosis: A large species reaching in excess of two and one-half meters in length; snout long, three times as long as high, nostrils round or oval, twice as far from orbit as from tip of snout; median supraoculars enlarged. Scales on crown of head larger than nuchal scales; dorsals scales keeled; ventrals feebly keeled; young blackish with transverse rows of rather large yellow ocelli. Below yellow; tail banded black and yellow throughout.

Description of species (from No. C.860 from "near Bangkok"):
Head elongate, snout more than half total length; nostril an elongate oval its distance from tip of snout half distance to orbit; rostral small, not wider than adjoining supralabials of which there are about 36 to mouth-angle, last five or six may be somewhat irregular; a groove from below nostril to eye, separated from lip for most of its distance by four scalerows (including infralabials); a longitudinal depression between and back of nostrils; a constriction of snout somewhat behind nostrils; seven or eight transversely widened supraoculars; median frontal scales nearly as large as largest nuchal scales; all scales on head smooth each with two or more pits; scales equal in temporal regions and area posterior to tympanum, smaller than other head scales; tympanum superficial, about as large as eye-opening, its posterior border partly covered by a skin-fold; mental no larger than adjoining infralabials, followed by two scales the first of two scale series separated by a longitudinal groove; a rather indistinct nuchal fold; dorsal scales keeled with an "apical" pit; distal subcaudal scales enlarged and strongly keeled; tail compressed, triangular in cross section; a double-toothed crest on top of tail; lateral scales forming small subequal transverse rows, growing larger at base and merging with larger subcaudal scales; pits on most lateral scales strongly developed.

Limbs strong, pentadactyl, clawed; digits surrounded by transverse rows of small scales, median series not modified; fourth toe longest with about 32 rows, scales of inner edge larger, tubercular; terminal scale above on digits enlarged, yellow; venter with transverse rows of subequal scales, about 80 between axilla and groin.

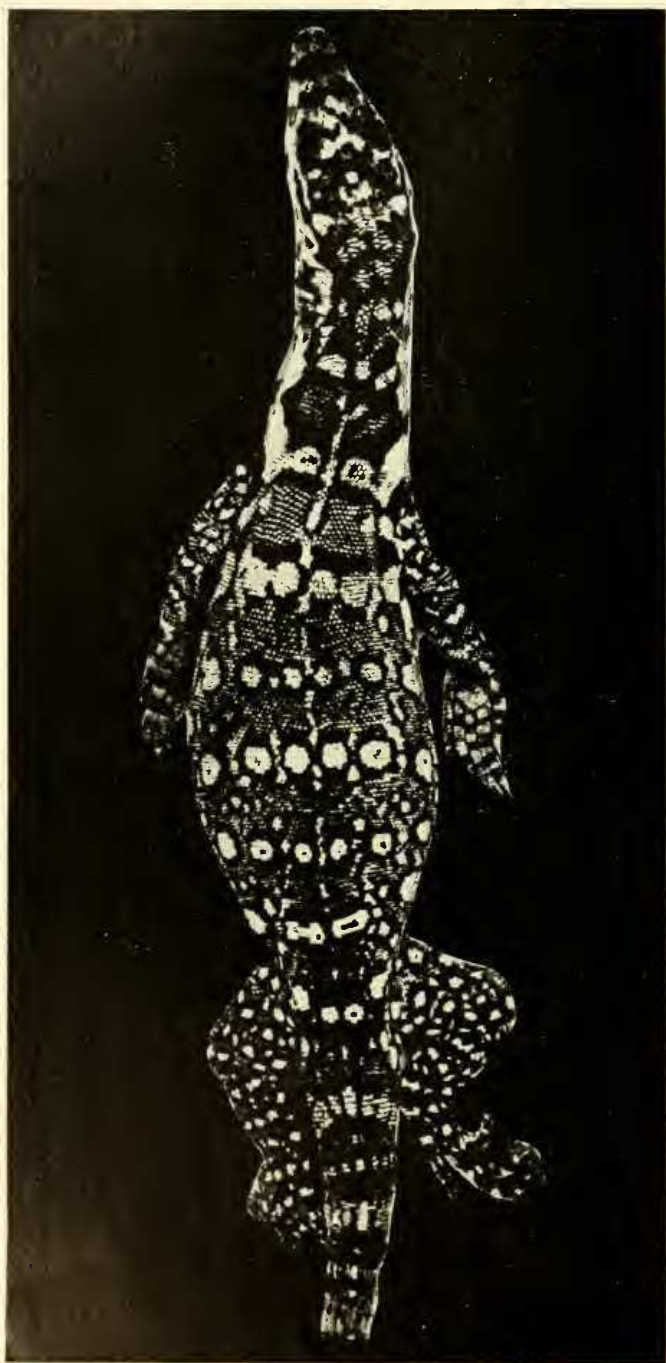


FIG. 58.—*Varanus salvator salvator* (Laurenti). From Mertens, Abh. senckenberg. naturf. Ges., 462, 1942, Tafel, fig. 21.

Two preanal pores on right side, one on left. A lateral fold indicated; pineal eye rather large, yellow in color.

Osteoderms present.

Color: Above olive-brown on top of head, largely yellowish to amber on sides of head; two yellowish spots above and around nostrils and one covering tip of snout; neck brown mixed with yellowish, the yellow growing more evident on sides of neck while under-surface is all yellow save for a few black flecks and spots suggesting incomplete transverse bars; arms and legs brown, punctate with yellow spots, the size of one scale, or larger on leg; back traversed by five rows of ocelli (black surrounded by yellow); tail banded but darker bands largely infiltrated with yellow and yellow bands with brown. Distally brown bands nearly uniform, the yellow bands, however, have longitudinal streaks; subcaudal region uniform yellowish.

Measurements in mm.: Snout to vent, 433; tail, 716; total length, 1149; snout to arm-insertion, 177; axilla to groin, 170; head width, 45; head length, 80; arm, 137; leg, 180.

Distribution: This subspecies has a wide distribution from India and Ceylon east and south through southeastern Asia, the Malay Peninsula and Indo-Australian Archipelago to the Philippines, Celebes, and northern Australia.

Remarks: This genus has been monographed by Dr. Robert Mertens in the *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* Abhs. 462, 465, and 466. A remarkable literature list and bibliography of this species contains more than 250 items.

In size, this species is second only to the "Komodo Dragon." Specimens measuring 2500 meters have been reported and they may even reach a larger size. It is probably the most widely distributed species of *Varanus*.

The young specimens have the markings clearly defined but these fade as the animal grows older and in many of the larger animals the pattern is almost completely lost, the color becoming dark olive with indistinct yellowish markings. In Thailand the species occurs throughout the country in suitable localities. They haunt the banks of streams and klongs and the seacoast in the vicinity of rivers.

Eggs are placed in hollow trees or where these are not available in holes near water.

The species is at least chiefly carnivorous and often feeds on meat in a rather advanced state of decay. Occasionally (in the southern part of the Philippines), they disinter corpses buried in shallow graves.

Varanus flavescens (Hardwicke and Gray)

Monitor flavescens Hardwicke and Gray, Zool. Journ., vol. 3, p. 226 (type locality, India).

Empagusia flavescens: Gray, Ann. Nag. Nat. Hist., vol. 1, 1838, p. 393 (India); Catalogue of the specimens of lizards in the collection of the British Museum, 1845, p. 9; Günther, Proc. Zool. Soc. London, 1860, p. 159; *ibid.*, 1861, p. 215.

Varanus flavescens: Cantor, Journ. Asiatic Soc. Bengal, vol. 16, 1847, p. 634 (Penang, Bengal, Nepal); Günther, The reptiles of British India, 1864, p. 65, pl. 9, fig. A; Theobald, Journ. Linn. Soc., vol. 10, Zool., 1868, pp. 23, 35; Theobald, in Mason, Burma, its people and productions, vol. 1, 1882, p. 326; Tirant, Notes sur les reptiles et les batraciens de la Cochinchine et du Cambodge, 1885, p. 76; Boulenger, The fauna of British India . . . Reptilia and Batrachia, 1890, p. 164; Boettger, Katalogue of the reptilien Sammlung . . ., 1893, vol. 1, p. 70; Boulenger, Fasciculi Malayenses, Zool., vol. 1, 1903, p. 174 (Malaya); A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 76 (Nepal, Bengal, Burma, Malay Peninsula [Trang and Penang]); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916; Journ. Bombay Nat. Hist. Soc., vol. 35, 1932, p. 616; The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 404-405; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 30, 1958, p. 1101 (in list).

Varanus (Empagusia) flavescens: Mertens, Abh. Senckenb. Naturf. Ges., Frankfurt am Main, Abh. 462, 465, 466, 1942, pp. 187-189 and 347-349, pl. 1, fig. 4, pl. 16, fig. 110 (the pagination continuous in the three numbers).

Diagnosis: A small species reaching about one meter in length with a short broad head; nostril slitlike nearer to tip of snout than to eye; median supraorbital scales widened transversely. Other head scales subequal; ventral scales smooth.

Description of species (from literature): Head rather short broad, snout convex rather than depressed or flattened; nostril elongate, oblique, slitlike, nearer end of snout than to orbit; distance from eye to ear-opening a little greater than distance between eye and nostril; about 18 supralabials and a similar number of infralabials; teeth subconical scarcely compressed. Dorsal head scales subequal save those in supraocular region somewhat widened transversely, nuchal scales larger than head scales, all of which are keeled; scales on venter in 65-75 transverse rows; limbs moderate, digits rather shorter proportionally than in other species. Tail strongly compressed with a double-toothed crest above subcaudal scales slightly larger than lateral scales which tend to form somewhat irregular transverse rows.

Color: Greenish or brownish olive, with irregular indistinct darker markings which usually become confluent to form cross-bars on back and tail; throat with dark irregular transverse bands.

Measurements in mm. (from M. Smith, 1935): Snout to vent, 365; tail, 465.

Variation: Mertens states that the head scales are rather large and smooth while the neck scales are larger than the posterior head scales and smooth or keeled. In the young the markings are strongly defined. Above they are dark brown with yellow flecks. A dark temporal stripe is present.

Distribution: The species in Thailand is known only from the Boulenger report from Trang (province). Elsewhere it has a wide distribution in northern India from the Punjab to western Bengal, and south through Burma to Malaya (Penang) and Indo-China.

Remarks: This is the smallest species of the genus to occur in Thailand. Those known are less than a meter in length.

Theobald, 1868, states (p. 23): "Large specimens are not often procurable as they are much sought after by both Birmanese and Karens as choice articles of food. They are hunted chiefly with dogs, whose scent enables them to discover the large Varans in the hollow trees in which they habitually shelter themselves.

"The Varani deposit their eggs in the ground usually selecting a deserted white ants' nest. The eggs are cylindrical, with tapering ends, of a dirty-white color and leathery texture . . . they are oily and feculent-looking, though devoid of any nauseous odor; and some Europeans eat them with pleasure."

Varanus bengalensis (Daudin)

Tupinambis bengalensis Daudin, Histoire naturelle des reptiles, vol. 3, 1802 (An XI), p. 67 (type-locality, Bengal).

Two subspecies are recognized, the typical one from India, and *nebulosus* with a range from southern Burma, Thailand, and Annam, throughout Malaya and Java. It is remarkable that it is unknown in Sumatra (*vide* Mertens).

Varanus bengalensis nebulosus (Gray)

FIG. 59

Monitor nebulosus Gray, in Griffith's Cuvier's Animal Kingdom, vol. 9, 1831, Synopsis, p. 27 (type-locality, Java).

Varanus nebulosus: Cantor, Journ. Asiat. Soc. Bengal, vol. 16, 1847, p. 633; Günther, The reptiles of British India, 1864, p. 66, pl. 9; Boulenger, Catalogue of the lizards in the British Museum, vol. 1885, p. 331; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 165; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 77; Fasciculi Malayenses, vol. 1, Zoology, 1903, p. 157; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, pt. 1, 1916, p. 54; *ibid.*, vol. 2, pt. 2, Dec. 1916, p. 155 (Patani, Nakhon Si Thammarat and Prachuap Khiri Kan); H. C. Smith, Journ. Bombay Nat. Hist. Soc., vol. 34, 1930, p. 370; Theobald, Journ. Linn. Soc., vol. 10, Zoology, 1868, p. 22; M. Smith, The Fauna of British India including Ceylon and Burma, . . . Reptilia and Amphibia, 1935, pp. 403-404.

Monitor nebulatus: Schlegel, Abbild, Amphib., 1839, p. 75.

Varanus bengalensis nebulosus: Taylor and Ellbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1042, 1101-1102.

Varanus (IndoVaranus) bengalensis nebulosus: Mertens, Abh. Senckenb. Naturf. Ges., Abh. no. 466, 1942, pp. 244-252, pl. 11, fig. 15.

Diagnosis: Scales on neck not strongly enlarged; nostril elongate, twice as close to the eye as to tip of snout; a series of five or six widened supraocular scales. Scales on dorsal surface suggest half covered eggs, each with a well-defined apical pit; they may be somewhat keeled; scales on neck only slightly larger; subcircular without keels. Dark above without transverse bands; two chevron-shaped dark marks on neck, anterior reaching to eyes; two broad dark bands on tail separated by smaller cream bands on distal part of tail; digits clawed, compressed, third and fourth fingers of equal length with about twenty transverse rows of scales surrounding digit; fourth toe longest, with about 25-28 transverse rows of scales. A row on inner basal region enlarged. Ear larger than eye-opening, posterior surface of tympanum partly covered by a fold of skin.

Description of species: Snout long, approximately equal to half length of head; nostril only slightly closer to eye than to tip of snout*; rostral small followed directly by paired scales, the first of two series forming a longitudinal groove on snout; 21 supralabials followed by five or six smaller scales to rictus oris; scales in frontal area larger than elsewhere on top of head. Four or five widened scales in supraocular region. All head scales with numerous "pits"; infralabials about 25, followed by a few smaller scales to rictus oris; mental scarcely larger than rostral, followed by two scales which are first of two enlarged regular rows, separated by a deep groove.

Scales on neck flattened, somewhat rounded or oval, not keeled, each with a pit; dorsal scales smaller, keeled, all in more or less straight transverse rows; ventral scales in about 70 transverse rows between axilla and groin, flat, rounded posteriorly; a pair of small preanal pores; a strong nuchal fold. An indistinct lateral nuchal fold; lateral fold on body scarcely indicated; tail triangular in cross-section with a double-toothed crest above, the scales on side of tail in transverse (vertical) rows; those on ventral surface of tail somewhat larger.

Color: Above blackish with numerous yellow scales scattered over arms, legs, on dorsum and sides. On the back the larger dots

* Boulenger (1912) description says, "nostril elongate, oblique, nearly twice as distant from end of snout as from orbit." This is probably in error. The same relationship is also indicated in the key.



FIG. 59.—*Varanus bengalensis nebulosus* (Gray). Young specimen, Pattani, Pattani province, circa. Natural size.

of yellow are usually surrounded by black scales forming small ocelli that are arranged in rather indefinite rows across back and base of tail. Chin with transverse bars of yellowish white and black; neck marbled. Underside of limbs with rosettelike groups of whitish scales; venter mottled white or yellow, and slate. Tail variegated and streaked except for two broad bands of black separated by narrower ones of yellow. Fingers with a yellow dorsal line and all digits with a yellow spot at base.

Measurements in mm.: Snout to vent, 220; tail, 348; width of head, 26; length of head, 52; arm, 74; leg, 96.

Remarks: Younger specimens are olive to black (snout to vent, 140 mm.), and have the chin strongly barred in bluish and yellow-cream; bars chevron-shaped, white on neck, very irregular; on breast and venter about 15 dark transverse bands with very irregular edges separated by rows of whitish spots more or less confluent; rounded or rosette light spots under limbs; head blackish with a series of white spots on upper lip; neck with a pair of dim dark lines from eyes meeting on neck; another chevron-shaped mark following it; back with numerous (16-17) transverse rows of tiny ocelli; arm and leg with punctate spots much smaller than on underside; two cream bands distally on tail; and two broader black bands.

Distribution: This species is very wide-spread in Thailand being known from Malaya north to Chiang Mai province, and east to Laos and Cambodia.

Outside of Thailand it is in Burma, Viet Nam, and Malaya. All specimens I have collected were found in trees.

The figure given is of still another young specimen.

FAMILY LACERTIDAE Cope

Lacertinidae, Gray, Ann. Philos., vol. 26, 1825, p. 200.

Lacertidae Cope, Proc. Acad. Nat. Sci. Philadelphia, 1864, p. 228 (*part.*).

Top of head covered with symmetrical shields. Tongue deeply notched and covered with scalelike papillae, or plicae; four limbs, well developed. Femoral pores present.

A single premaxillary bone; both nasal and frontal bones paired, parietal single; postorbital and frontosquamosal arches present; dermal bones on head and above fossae, none on body; dentition pleurodont.

This family is confined to the eastern hemisphere with a single genus entering Thailand.

GENUS TAKYDROMUS Daudin

Takydromus Daudin, Histoire naturelle des reptiles, vol. 3, 1802, p. 251 (type of genus, *quadrilineatus*).

Tachydromus Günther (emendation), Ann. Mag. Nat. Hist., series 6, vol. 1, 1888, p. 166.

Head shields consisting of rostral, frontonasal, prefrontals, a frontal, supraoculars, frontoparietal, interparietal, parietals, and occipital; nostril between three scales; lower eyelid scaly; dorsal surface of body with enlarged series of keeled shields that form continuous ridges; several series of fine granular scales along side.

Ventrals large, keeled, in definite rows. Limbs well developed. One to three femoral pores on each side.

Some 12 forms are recognized that range from China and Japan to Indo-China, Thailand, Burma, India, and northern Malaya.

Takydromus sexlineatus Daudin

In Thailand only a single species is known. Only one of its two subspecies has been found within the country the other is likely to occur.

KEY TO THE SUBSPECIES OF TAKYDROMUS SEXLINEATUS

- Two preanal pores on each side; head-shields smooth except frontal, which is keeled *s. sexlineatus*
 One preanal pore on each side; head-shields rugose or keeled *s. ocellatus*

Takydromus sexlineatus ocellatus Cuvier

FIG. 60

Takydromus ocellatus Cuvier, Guérin, Icon. Règne Animal., Reptilia, 1829, pl. 5, fig. 3 (type-locality, "les Indes orientales"); Duvernoy, Règne Animal., Reptilia, 1836, pl. 11 (Cochin-China regarded as probable type-locality).

Tachydromus typus Gray, Ann. Mag. Nat. Hist., vol. 1, 1838, p. 389 (type-locality, China).

Tachydromus typicus Gray, Catalogue of the lizards in the collection of the British Museum, 1845, p. 52.

Tachydromus meridionalis Günther, The reptiles of British India, 1864, p. 70, pl. 8, fig. D (type-locality, S. China).

Tachydromus sexlineatus meridionalis: Stejneger, Proc. U. S. Nat. Mus., vol. 66, 1925, p. 55; Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, pp. 419, 487.

Tachydromus sexlineatus: M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 155; *ibid.*, vol. 6, 1923, p. 200; Boulenger, A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 79.

Tachydromus sexlineatus: M. Smith, Bull. Raffles Mus., no. 3, 1930, p. 29.

Tachydromus sexlineatus ocellatus: M. Smith, The fauna of British India . . . Reptiles and Amphibia, vol. 2, Sauria, 1935, pp. 368-369.

Diagnosis: A tail nearly four times as long as distance from snout to vent; six enlarged scalerows on neck and front half of body followed by four, all strongly keeled, keels forming continuous lines;

nasals meeting on median line; frontal with a ridge or keel; 10-14 ventral rows of enlarged keeled scales, keels forming continuous straight lines; a single preanal pore on each side. Anal scale single, large flanked by two small scales on each side.

Description of species (from No. 35520 from near Rompibon, Tonka Harbour Tin Mine), Nakhon Si Thammarat): Rostral large, suture between rostral and first labial directly below nostril; nasals in broad contact behind rostral; frontonasal longer than broad touching one loreal; prefrontals elongate, broadly in contact; frontal with a strong median keel; frontoparietals broadly in contact, larger than prefrontals; interparietal small; parietals with an irregular keel separated from each other by interparietal and a small "occipital" scale behind it; nostril between nasal, first supralabial and a post-nasal; two loreals, second much the larger with an upper posterior process passing partly above first supraciliary; three supraoculars, first largest, last smallest; four (or three) supraciliaries; six supralabials, smooth except subocular (fifth) which is much elongated and with a strong curving keel; one presubocular; two or three post-suboculars; parietal bordered by three elongate keeled temporals, below which are about eight rows of smaller keeled temporal scales; a narrow elongate curved scale forms upper boundary of tympanum; latter rather deeply sunk, as large as eye-opening; mental very large, its labial border equal to that of rostral and two adjoining supralabials; three pairs of chinshields, first smallest in contact, second pair partly separated, third, much the largest, diverging, separated by from two to ten scales all bordering infralabials; five or six narrow infralabials; six mesial rows of enlarged keeled scutes on neck and shoulders; four rows at mid-body continuing to tail; scales on sides small; a large patch in groin and axillary region, while in the middle of body there are about five to seven rows of granules; twelve enlarged scalerows on venter, and ventrolaterally an outer row bordering these about half as large, all keeled, the keels forming straight lines as they do on dorsal scales; a mere suggestion of a collar; caudal scales strongly keeled, forming transverse rows, keels tending to form continuous lines.

Arms with large keeled scales except on underside of upper arm; fourth finger longer than third, nearly cylindrical with 17 lamellae below; leg with enlarged keeled scales except on underside and part of posterior surface of thigh; 23 lamellae on underside of fourth toe, basal ones divided. Eyelid scaled; 27 scales from collar to groin; anal a large single scale with two low keels indicated, flanked

by smaller elongate keeled scales; a specialized scale directly in front of single pore-scale on each side.

Color: Head dark-olive; body greenish olive growing lighter on sides; a narrow dark line begins on second loreal, passes eye and continues above tympanum to some distance on neck and shoulder;



FIG. 60.—*Takydromus sexlineatus ocellatus* Cuvier, in Guérin. No. 35520, Ronpibon, Nakhon Si Thammarat. Actual length, snout to vent, 55; tail, 208 mm.

on side of neck and temporal region ultramarine; sides bordered by a dim greenish white line that is bordered below by an indefinite light-olive line; venter bluish- to greenish-white, continued on subcaudal region; no indication of small ocellate spots on flanks.

Measurements in mm.: Snout to vent, 55; tail, 208; snout to arm insertion, 19.6; axilla to groin, 30; width of head, 6.6; length of head, 13.6; arm, 17; leg, 25.

Variation: On the neck of this subspecies there are six rows of large scales. In one specimen examined these did not pass beyond a line drawn between arms; in two others they reached approximately halfway between the arms and legs, where they reduce to four rows.

Usually in freshly caught or preserved specimens the ocelli are distinct in the males; however, these marks disappear after long preservation.

A recently preserved specimen from Mae Hong Son shows two or three ocelli present at the base of the tail. This specimen has a shorter fifth toe than other specimens and the underside of hand and foot and the lamellae under the digits are a very vivid lemon-yellow, the color sharply limited on heel and wrist as well as on the sides, foot, and hands. The base of the tail is noticeably swollen in males.

This specimen has the regenerated portion of tail measuring 74 mm., while the scales on the reproduced portion are smaller, the scales have almost the same characteristics as those of the original tail.

Distribution: This subspecies has been taken in Chiang Mai, Mae Hong Son, Bangkok, Nakhon Si Thammarat, and Pattani. It probably occurs throughout most of Thailand although nowhere does it seem to be common.

This form reaches Indo-China, South China, Hainan, and the northern states of Malaya and Burma.

Remarks: These long-tailed lizards are egg-layers, the clutch consisting of from two to four eggs.

The tail is extremely long, nearly cylindrical and not especially fragile.

The animal moves with considerable speed. They are said to run over the tops of long grass in search for food. I have not seen this.

FAMILY SCINCIDAE

This group of lizards was given family rank by John Edward Gray in 1825, and very little effort has been made to break it into other families except by Gray himself who in his Catalogue of 1845 proposed four other families for species which he had formerly placed in the family Scincidae. The four proposed families have not been recognized by taxonomists of the present century.

The family group may be defined as follows:

Skull covered over and united with a series of dermal bones also covering the supratemporal aperture; postfrontosquamosal arch complete in all except certain reduced burrowing forms.

Tongue, bifid in front, covered with imbricating papilla. Teeth pleurodont, usually conical, more rarely hooked or spheroidal; abdominal ribs or parasternae present in certain burrowing forms; scales covering body, limbs and tail; osteoderms present. Head likewise with osteoderms but outer surface covered with large symmetrical plates. Limbs variable, often absent; femoral and preanal pores absent; postanal pores may be present. Tail fragile, when broken off it is reproduced without vertebrae.

There is no general agreement in regard to the generic groupings in this family. There are about 650 species recognized, the smallest number being in the Western Hemisphere, where only four genera are represented. The areas most thickly inhabited by the skinks are South Asia, the Malayan Archipelago, the Philippines, and Australia.

The general habitat of the skinks is terrestrial but a considerable number of species of numerous genera have become arboreal or at least semiarboreal. However, in most cases, there has been no special modifications of the limbs or digits save for a freer movement of the digits and a strengthening of the claws.

A few species of *Emoia*, and *Leiopisma* have the subdigital lamellae increased in number, permitting them seemingly to climb on smooth-leaved plants or smooth-surfaced trees.

One of the remarkable happenings in a number of genera of the Scincidae is that certain species seem to be losing parts of the limbs and the animals are preparing to assume a subterranean existence or they have already lost their limbs and have become somewhat snakelike in appearance.

In the Philippine genus *Brachymeles* one sees this process at its

best. This genus has some typical pentadactyl species, in which the length of limbs and of body is much as in the typical generalized lizard, the limbs touching or overlapping when adpressed. Another species has the limbs shortened, the body and tail lengthened; others in which varying numbers of the digits have been lost; others with all digits gone and only a stub of a limb present; others with all external trace of limbs gone.

The evolutionary happenings would appear to be following a specific trend. One might propose a formula for the results of mutations that bring about the changes. Thus starting with a typical pentadactyl species represented by 5-5, the following might represent the major stages of digit and limb loss:

STAGE	Digit condition	STAGE	Digit condition
1.....	5-5	8.....	1-2
2.....	4-5	9.....	1-1
3.....	4-4	10.....	0-1
4.....	3-4	11.....	0-0
4a.....	4-3	12.....	arm-leg
5.....	3-3	13.....	no arm-leg
6.....	2-3	13a.....	arm-no leg
7.....	2-2	14.....	no arm-no leg

One cannot assume that the digit is lost by a single mutation. It may require x-number of mutations to produce the total loss of a digit.

The fact that populations found at any of these major stages show but very little variation in the character and condition of the digits is, however, significant, and suggests that there may be at least a temporary fixation of the condition at these stages.

While the genus *Brachymeles* does not show all of the 14 or more possibilities, offered by the formula, a considerable number of these are present, each found with a continuous range and two or three may be found with their ranges overlapping. Despite these considerable, seemingly generic, differences between certain of these species, one is constrained to regard the group as belonging to a single genus because of basic similarities.

Since this ability to produce degradational forms appears in so many genera of the Scincidae one is likely to postulate that this type of behavior is an inherent possibility in any group of limbed lizards. However, in the case of the genus *Scelotes*, a curious mu-

tational behavior permits loss of digits on one side of the Mozambique channel, while on the other side on the African mainland, the limbs become reduced, the body elongates, but no digits are lost. Does this not suggest the presence of some inhibiting factor? or if not, that the mutation toward loss of digits is lethal on one side, and none survive in this condition?

In Thailand several genera seem to have been undergoing these degradational mutations and often the animal, only in the ultimate stages of the formula seems to have survived.

Examples of Asiatic lizards that seem to have survived because of having reached this degradational stage, are *Ophioscincus* with two species; *Barkudia* with a single species; *Ophisaurus* with two species; *Isopachus* with one.

Some other genera no longer have any known pentadactyl representatives: *Nessia* with species representing stages, 5, 7, 11, 12, (2) 13. *Dibamus* with several species, the females in stage 13, the males, stage 12.

Certain other genera are *Chalcidoceps*, stage 3, *Sepsophis*, usually stage 9, *Ophiomorus*, stage 5, and two forms with four fingers and three toes, stage 4a.

Lygosoma quadrupes and *Riopa haroldyoungi* represent pentadactyl species in which the body has elongated and the limbs have become small, but the five digits have been retained. Do these represent genera in which mutations involving digital loss are lethal?

The greater number of the degradational species show the hand keeping ahead of the foot in loss of digits. A few exceptions do occur as is indicated under *Ophiomorus*.

In *Amphisbaena*—another Order of reptiles, in one genus, *Bipes* (and the only genus with any trace of limbs) the arm has been retained with five, three, or two digits, while the leg is completely lost. One suspects that these forms may move into underground burrows backwards! Certainly *Bipes* that I have observed moves forward and backward in its burrows with nearly equal ease.

If one accepts the idea that mutations are miraculous—that is, happening by chance without any physical (internal or external) causation, one is being properly orthodox. On the other hand if one might be permitted to suspect that these mutations are stimulated (or caused), one might suspect that the relation of body to burrow might provide a mechanism that tends to trigger the mutation, were such possible.

KEY TO THE GENERA OF SCINCIDAE IN THAILAND

1. Palatine bones separated on median line of palate; nostril pierced in a single nasal, supranasals present; a paired frontoparietal, *Eumeces*
Palatine bones meeting on mid-line of palate 2
2. Pterygoid bones separated; palatal notch extending forward to level of middle of eyes; supranasals present; legs pentadactyl, well developed *Mabuya*
Pterygoid bones usually meeting on palate, palatal notch not reaching level of centers of eyes 3
3. Limbs absent 4
Limbs present 5
4. Frontonasal present; frontoparietals broadly in contact; no ear-opening; body slender, elongate, tail blunt or somewhat pointed at tip, *Ophioscincus*
No frontonasal; frontoparietals separated; no ear-opening; body not slender; tail blunt *Isopachus*
5. Supranasals present; tympanum deeply sunk 6
Supranasals absent 7
6. Limbs elongate the leg reaching elbow when adpressed; lower eyelid scaly *Dasia*
Limbs usually short, the body often elongated; the lower eyelid scaly; adpressed limbs fail to meet *Riopa*
7. Tympanum exposed, superficial; eyelid scaly; one, two, or three enlarged preanal scales *Tropidophorus*
Tympanum not superficial, but more or less deeply sunk 8
8. Lower eyelid with a transparent disc, frontoparietal double (rarely single) 9
Lower eyelid scaled; limbs overlapping; frontoparietals double; rostral convex or flattened *Sphenomorphus*
9. Ear-opening very distinct; frontoparietal single or double; nuchals present or absent *Leiopisma*
Ear-opening hidden under scales; single frontoparietal; three or four pairs of nuchals; 18-20 scalerows about body; four black longitudinal stripes. Snout to vent, 38 mm. *Saiphos*

GENUS EUMECES Wiegmann

- Lacerta* (part.) Linnaeus, Systema naturae, 10th ed., vol. 1, 1758, p. 205.
Scincus (part.) Harlan, Journ. Acad. Nat. Sci. Philadelphia, vol. 4, pt. 2, 1824, p. 286.
Mabuya (part.) Fitzinger, Neue Klass. Rept., 1826, p. 23.
Euprepis (part.) Wagler, Nat. Syst. Amph., 1830, p. 161.
Eumeces Wiegmann, Herpetologia Mexicana, 1834, p. 36 (type, *Sincus pavimentatus*) (part.); Taylor, Univ. Kansas Sci. Bull., vol. 23, pp. 29-30, 1935.
Plestiodon Duméril and Bibron, Érpétologie générale, vol. 5, 1839, p. 697 (subgenus); Gray, Catalogue of the species of lizards in the collection of the British Museum, 1845, p. 90 (genus).
Lamprosaurus, Hallowell, Proc. Acad. Nat. Sci. Philadelphia, 1852, p. 206 (type *Lamprosaurus guttilatus* = *Eumeces obsoletus*).
Eurylepis Blyth, Journ. Asiat. Soc. Bengal, vol. 23, p. 739 (type *Eurylepis taeniolatus*).

Mabuya Günther, Reptiles of British India, 1864, p. 82.

Platypholis (non Boulenger) Dugès La Natureza, 2nd ser., vol. 1, 1887, p. 486 (type, *Eumeces altamirani*).

Description: Maxillary and mandibular teeth conical or with rounded spheroid crowns variable in number; premaxillary teeth usually 7; pterygoid teeth present, variable in size and number; prevomerine teeth present or absent (usually two where present); palatine bones not meeting on median plane of palate, but varying in degree of proximity; pterygoids separated on median line.

Eyelids well developed, the upper variable; tympanum deeply sunk; nostril in a nasal, single, partly divided or more or less completely divided; supranasals present; four supraoculars; two prefrontals, two frontoparietals, parietals and a single interparietal. Limbs well developed, pentadaetyl, clawed; digits subcylindrical or compressed, with transverse scales on undersurface which may be compressed, keeled, or padlike in character. Scales with osteoderms, more or less cycloid, imbricating, occasionally fusing dorsally into larger plates.

Only a single species is known to occur in Thailand. Elsewhere the genus has a distribution in Japan, China, Asia Minor, North Africa, North and Central America, and the islands of Bermuda.

Eumeces quadrilineatus (Blyth)

FIG. 61

Plestiodon quadrilineatus Blyth, Journ. Asiat. Soc. Bengal, vol. 22, 1853, p. 652 (type-locality, China, presumably Hong Kong).

Eumeces quadrivirgatus Hallowell, Proc. Acad. Nat. Sci., Philadelphia, 1860, p. 502 (type-locality, Hong Kong).

Mabouia quadrilineata: Günther, The reptiles of British India, 1864, pp. 82-83, pl. 10, fig. E; Theobald, Journ. Asiat. Soc. Bengal, extra number, 146, 1866, p. 24 (Hong Kong).

Eumeces quadrilineatus: Bocourt, Mission Scientifique au Mexique et dans la Amérique Centrale, livr. 6, 1879, p. 423, pl. 22 D, fig. 5 (Cambodia); Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 381; Günther, Ann. Mus. Zool. St. Petersbourg, vol. 1, 1896, pp. 199-219 (Szechuan); Mocquard, La Revue Coloniale, July, 1906 (1907), p. 37; Mell, Arch. Naturg., 88 abt. a, 10 Heft, 1922, p. 114; Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, p. 428, fig. 12; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 8, no. 1, Dec. 1929, p. 49 ("Muak Lek near Korat," Siam); Taylor, Univ. Kansas Sci. Bull., vol. 23, 1935, pp. 452-457, pl. 40, fig. 1, text figs. 74-75; M. Smith, The fauna of British India, Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 339-340 (Doi Angka, Dong Paya Fai Mts., Siam).

Diagnosis: Two median dorsal scalerows broader than adjoining rows. A postnasal present; 20 to 22 scalerows around middle of body; a pair of dorsolateral greenish-white stripes from rostral to

some distance on tail; an outer lateral stripe beginning on lips, passes to groin and along the base of tail.

Description of species: Snout moderately short, portion of rostral visible above less than half size of frontonasal; supranasals large forming a median suture, touching postnasal and first loreal; frontonasal large, broader than long, touching anterior loreal; prefrontals forming a relatively broad median suture, and in contact with frontonasal, frontal, posterior loreal, first supraocular, first superciliary and anterior loreal, length of their common sutures in the order named; frontal relatively short, obtusely angulate at both ends, shorter than its distance from end of snout; frontoparietals elongate, larger than prefrontals or interparietal, forming a median suture; interparietal small, enclosed behind by large parietals; three pairs of nuchals, anterior pair shortest transversely.

Nasal moderate, divided; postnasal small but distinct, touching two labials; anterior loreal high and narrow, higher than posterior; latter longer than high; seven—eight supraciliaries, first larger than last; a small preocular, two postoculars; four supraoculars, three anterior touching frontal; two presuboculars and four postsuboculars; four enlarged scutes on lower eyelid, separated from subocular labial by three rows of granules; primary temporal square, touching triangular lower secondary temporal narrowly; upper secondary temporal large (broken into two parts on left side); tertiary temporal touches upper secondary but is separated from nuchal; seven supralabials (eight on left side), seventh very large, separated from ear-opening by two paired scales. Eighteen scales surround ear.

Mental large, with a labial border greater than that of rostral; six infralabials; two postmentals, second largest; three pairs of chinshields, posterior largest; anterior pair in contact.

Two median scalerows widest; 54 scales in a row from parietals to above vent; about 30 scalerows around occipital region at ear; 26 at constricted part of neck; 20 rows about middle of body. A well-developed wrist tubercle; 13 to 14 lamellae under longest fingers; 19 lamellae under longest toes; six preanals, the two median enlarged; subcaudal scales much widened; adpressed limbs overlap the length of seven scales; postfemoral scales not differentiated.

Color: Back dark gray-brown, head more yellowish brown, with a darker area in interparietal region. A silvery dorsolateral line from rostral extends along side to a point half way on tail, covering greater part of second scalerows but encroaching on median rows



FIG. 61—*Eumeces quadrilineatus* Blyth. No. 31791; 1780 m. Namlang (Mt.), Bankhok, Dan Sai, Loei province. Actual total length, 97 mm.

on base of tail; the light lateral line begins on lips and extends on fifth row to base of tail; lateral area between white lines colored like back; below on venter brownish cream.

Measurements in mm.: Snout to vent, 73; tail, 63 (regenerated; normal length probably about 125 mm.); snout to eye, 4.8; snout to ear, 14; snout to arm, 26; axilla to groin, 40; width of head, 12; arm, 22; leg, 28.

Distribution: The species has been taken only a few times in Thailand. The localities are, near Muak Lek (but in Nakhon Ratchisima province; Doi Nang Ka Mt., Chiang Mai province). I have a specimen (illustrated) taken in Loei Province, and a second specimen taken from the stomach of a *Natrix* from an uncertain locality.

Genus MABUYA Fitzinger

Mabuya, Fitzinger, Verzeichniss der im K. K. Zoologisch Museum zu Wien befindlichen In Neue Classification der Reptilien, 1826, pp. 23, 52 (type *Lacertus mabouya* de la Cèpede, *vide* Malcolm Smith, 1935, p. 257).

Diagnosis: Palatine bones in contact mesially, palatal notch entirely separating pterygoids, reaching forward to between eyes; pterygoid teeth present or absent; maxillary teeth conical or bicuspid; eyelids well developed, lower lid with a transparent disc or with a series of opaque scales; ear with tympanum deeply sunk; nostril in single nasal; supranasals present; prefrontals present; normally two frontoparietals (rarely united in a single shield); interparietal distinct or rarely united with parietals; limbs strong, well developed, pentadactyl. Digits with transverse lamellae inferiorly.

There are six species of this genus in Thailand, one species recognized with three subspecific forms. The following key will serve to distinguish the known forms of the country.

KEY TO THAI SPECIES OF MABUYA

1. Lower eyelid with transparent disc; 32-34 scalerows about body; dorsal scales with three strongly defined keels and six or more additional keels; no postnasal *novemcarinata*
- Lower eyelid with several scales instead of a disc; postnasal present or absent 2
2. Scales finely striate, with two or three feeble keels; 26-30 scalerows around middle of body; tail very long; a postnasal *longicaudata*
- Scales not striate; keeled 3
3. Five to seven dorsal greenish-white longitudinal lines or olive unicolor; 5-7 keels on dorsal and lateral scales; 24-28 scalerows around middle of body *rugifera*
- Without five to seven greenish-white longitudinal lines; number of keels variable; not olive unicolor 4

4. Three to five keels on dorsal scales; 30-34 scalerows around body at middle; no specialized scales on leg forming "chigger refuge"; a postnasal present *multifasciata*
 Five, seven, or nine keels present at various points on body; a "chigger refuge" on lower leg; postnasal present or absent *macularia*

In Malcolm Smith's treatment of this genus he referred to it (June 1916, p. 55) *Lygosoma praesigne* Boulenger. His comments on this follow: "The pterygoid bones being entirely separated, and the palatal notch extending forward as far as a line connecting the centres of the eyes, this species should be placed under *Mabuia* instead of under *Lygosoma* as hitherto, although its affinities, notably the absence of supranasals, are with the latter genus. The evidence for this transfer is based upon specimens obtained last year in the mountains of Nakon Sitamarat, and now lodged in the British Museum."

I do not regard this placement tenable. Should examination of the skulls of various species of *Mabuia* and *L. praesigne* prove the condition mentioned by Dr. Smith as constant then *praesigne* might well represent a monotypic genus. In practically if not all its external characters it is a member of the genus *Sphenomorphus*, lacking, as it does, the characteristic keeled scales, the enlarged second supraocular, the posteriorly truncate parietals; the paired supranasals, the several rows of granular scales between the supraciliaries and the palpebral scales, the characteristic auricular opening, small preanals, that are usually, if not always, characteristic of South-eastern Asiatic *Mabuia*.

Mabuia novemcarinata (Anderson)

FIG. 62

Euprepes novemcarinatus Anderson, Journ. Asiat. Soc. Bengal, vol. 40, 1871, p. 12 (type-locality, Mandalay, Burma).

Mabuia novemcarinata: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1888, p. 179; The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, p. 187; A vertebrate fauna of Malaya from Singapore to the Isthmus of Kra . . . Reptilia and Batrachia, 1912, pp. 82-83; Flower, Proc. Zool. Soc. London, 1896, p. 873.

Mabuia novemcarinata: Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, p. 261; Bull. Raffles Mus., no. 3, Apr. 1930, p. 30.

Diagnosis: Supranasals usually in contact behind rostral; prefrontals usually separated or rarely touching; no postnasal; lower eyelid with an undivided transparent disc; dorsals and lateral scales with 7 to 11 sharp keels; 32 to 34 scales about middle of body.

Description of species (from No. 227, Coffee Camp near Na Bon, Nakhon Si Thammarat): Rostral broader than high, forming a

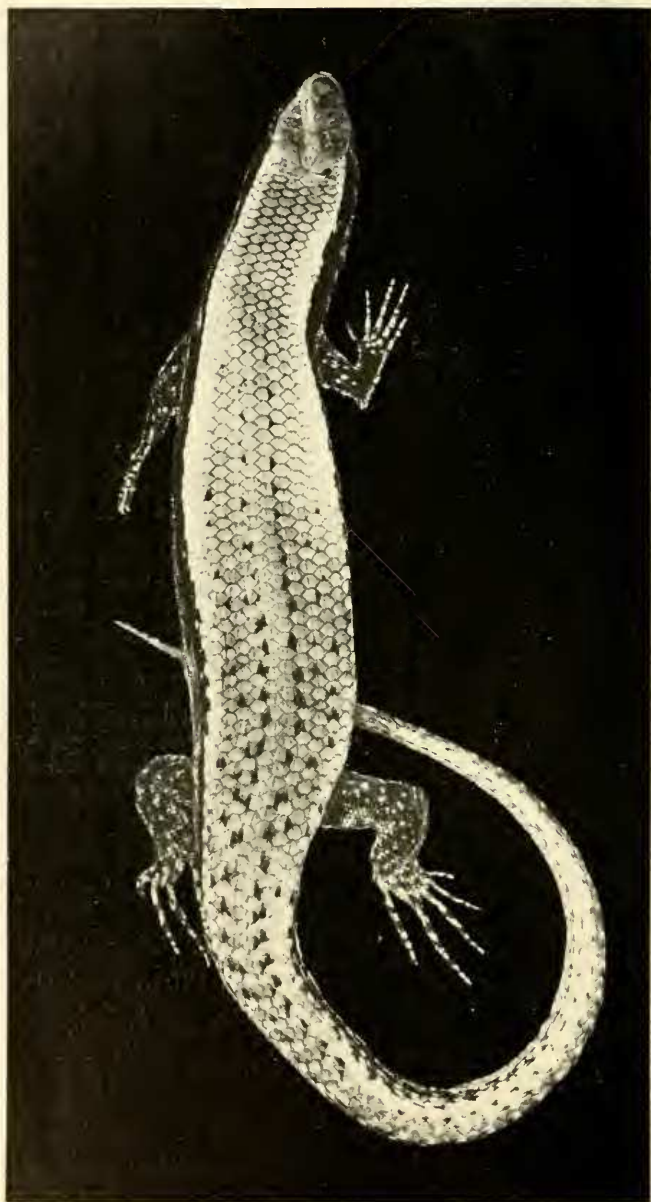


FIG. 62.—*Mabuya novemcarinata* (Anderson). No. 33751, Khao Chong, Trang province. Actual length, 145 mm.

broad angle above; pair of supranasals in contact mesially; frontonasal a little broader than long forming suture with frontal, and prefrontals, laterally touching anterior loreal; frontal longer than its distance from tip of snout, slightly longer than its distance from nuchal; two frontoparietals; interparietal as large as preceding scales, separating parietals, which are keeled posteriorly; a pair of nuchals each with about 15 keels; nostril in single nasal; no postnasal; two loreals, anterior as high but not as long as second; two presuboculars; prefrontals quadrangular, touching both loreals, first supraciliary and first two supraoculars; four supraoculars, second and third in contact with frontal; six supraciliaries, first and last largest; two or three postsuboculars; seven supralabials, fifth subocular, latter more than twice as wide as preceding supralabial; two anterior and three posterior temporals; mental with a labial border much larger than that of rostral; single postmental; first chinshields in contact, second pair separated by a scale; six infralabials; lower eyelid with large transparent disc; auricular opening with two well-developed anterior lobules. Dorsal and lateral scales strongly keeled, two keels much stronger than others; altogether they vary from seven to ten although nine is probably most frequent number; temporal scales at least partially keeled; scales on limbs with three to five keels; all ventral scales smooth; 34 scalerows around middle of body; six to eight preanals, two median widest; subcaudals not modified; 12 lamellae under longest fingers; 17 under longest toes; those at base of toes somewhat tuberculate, distal ones flattened, usually without median keel.

Color: Dark brown above, with two series of blackish indefinite marks beginning behind shoulders, becoming larger posteriorly; toward back of body and base of tail they are practically transverse lines, interrupted mesially; on tail they form rather dim transverse marks, separated by very narrow lighter lines, more or less continuous with similar marks on side of tail; a narrow dorsolateral line evident anteriorly, vaguely evident posteriorly and on tail; a broad dark-brown stripe begins behind eye, continues along side of body and for some distance on tail, not surrounding ear. Labials bluish white with black dots; below lateral brown stripe, numerous blue-white markings and dots, together with black dots and flecks border venter; latter greenish-white in life, bluish in fixative, scales with lighter centers; mental white.

Measurements in mm.: Snout to vent, 71; tail partly regenerated,

74; snout to arm-insertion, 27; axilla to groin, 37, head width, 11.8; head length, 17; arm, 21; leg, 28.

Distribution: The specimens reported here are presumably the first to have been found in Thailand. These are from the following localities: Nos. 169, 226, 227, Coffee Camp, Na Bon, Nakhon Si Thammarat; 1430, Bukit Bayu, "Mt. of the sleeping Buddha," Yala; 1384, Bukit Besar,* at waterfall near Na Pradoo, Pattani; Nos. 35751-35753, Khao Chong, Trang.

Remarks: The specimen figured (No. 35751, Khao Chong, Trang) is considerably larger than the described specimen and the dark coloration on the back and tail is less than described.

The behavior of the species is especially different from *Mabuya multifasciata* which is of comparable size. Specimens have not been seen moving about in the daytime but have invariably been dug out of dry soft earth under the edge of limestone rocks or from pockets of soil collected about buttresses of trees. They are surprisingly rapid in their movements, and most specimens routed from their hiding places escaped. Certain ones were found in dry dust under a high overhanging cliff. These were accidentally disturbed and both escaped. I returned next day and found both in the same small pocket of dust and both were captured.

This species has not previously been reported from Thailand.

Mabuya longicaudata (Hallowell)

FIG. 63

Euprepis longicaudata Hallowell, Trans. Amer. Philos. Soc., ser. 2, vol. 11, 1857, p. 77, pl. 4, fig. 1 (type-locality, Bangkok, Siam [restricted]).

Mabua longicaudata: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 188; Stejneger, Bull. U. S. Nat. Mus., no. 58, 1907, pp. 214-215, pl. 16; Van Denburgh, Proc. California Acad. Sci., 1912, pp. 228-229; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, June, 1916, p. 55.

Eumeces siamensis Günther, Reptiles of British India, 1864, p. 91 (type-locality, Bangkok, Thailand [restricted]).

Mabua siamensis: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 188; Flower, Proc. Zool. Soc. London, 1899, p. 647; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 84.

Euprepes (Tiliqua) ruhstrati Fischer, Abb. Nat. Hamburg, 1886, p. 7, pl. 1, fig. 2 (type-locality, Formosa); Van Denburgh, Proc. California Acad. Sci., 1912, p. 229.

Euprepes (Tiliqua) bicarinatus Peters, Mon. Akad. Wiss. Berlin, 1867, p. 22 (type-locality, Hong Kong).

* The Malay name of this mountain is still used in the south. The mountain lies at the boundary of the provinces of Yala, Pattani, and Songkhla and embraces a part of each. Na Pradoo is situated about two kilometers from the extreme northeastern part of the mountain. The "waterfall" is about eight kilometers northwest of Na Pradoo. This mountain was first explored herpetologically by Annandale and Robinson, 1901-1902. At this time Pattani was divided into seven states: Rhaman, Jalor, Nawngchik, Tibaw, Jhering, Telubin, and Pattani. Certain new forms described from this area have been overlooked by certain writers, as being within the country of Thailand.

Mabuya longicaudata: M. Smith, The Fauna of British India, including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 270-271; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, pp. 1109-1110.

Diagnosis: Large skink; dorsal scales with fine, usually wavy striations and two dim keels anteriorly, three evident near base of tail; lower eyelid scaled, lacking disc; a postnasal and supranasals; prefrontals form a median suture. Arms and legs well developed; leg reaching palm when arm is adpressed; 26-30 scales around body.

Description of species (from No. 33186, Sara Buri province): Rostral much broader than high, rather narrowly visible from above; supranasals form median suture; frontonasal broader than long, touching first loreal; prefrontals large, very narrowly separated mesially; frontal longer than wide, its length equal to its distance from tip of snout, and equal to combined parietals, touching frontonasal; nostril in posterior part of nasal, the posterior edge a narrow rim; a postnasal; anterior loreal higher than second, slightly higher than wide; posterior loreal longer than high; small preocular; two presuboculars; four supraoculars, second not or barely touching prefrontal, leaving two supraoculars touching frontal; six supraciliaries; seven supralabials, fifth below eye nearly twice as long as high; labial border of mental exceeding that of rostral; one undivided postmental; first chinshields in contact, second pair separated by one scale, third pair not greatly enlarged, separated; ear-opening small with three rounded lobules projecting from anterior border; four somewhat enlarged preanal scales.

Arms and legs well developed; digits covered below with flat lamellae, about 17 under longest fingers, 24-25 under longest toes; leg when adpressed reaches palm of hand, or a little farther.

Scales around body subequal, nearly or completely smooth on temples and neck; dorsal scales striate usually with two dim obtuse keels; scales on tail with three more or less well-defined keels; ventral and many laterals scales smooth; 28 scales around middle of body; 47 transverse scalerows from parietal to above vent; tail regenerated.

Color: Nearly uniform brownish or brownish-olive above with the head a little darker; broad dark-brown to black lateral stripe covering three scalerows; below, this margined dorsolaterally by a light line composed of small ill-defined dots; labials greenish with some black flecks; venter nearly uniform yellow-green, at times approaching canary-yellow; sole, palm, and underside of digits brown.

Measurements in mm.: Snout to vent, 117; tail, regen.; head



FIG. 63.—*Mabuya longicaudata* (Hallowell) No. 34240, Bang Saen, Chon Buri, Thailand. About natural size.

width, 11; head length, 26; arm, 31; leg, 43; snout to ear, 21; snout to arm, 39; axilla to groin, 56.

Variation: This is one of the larger species of *Mabuya*, the tail usually measuring nearly twice the snout-vent length. The subcaudals are 127 and 128 in two Thai specimens. The number of scales around the middle of the body is usually 28 although 26 and 30 have been reported. Transverse scalerows from parietal to above vent vary between 47-49.

One specimen examined shows a wider dorsolateral light line (bluish white) covering one and one-half scalerows. There are seven dim dark lines visible on dorsum. Another shows the dorsolateral light line invaded by black above and below thus leaving a line bordered above and below by blackish triangular dots for a part of its length.

In the young, the lateral stripe is deep black and there are no white dots in evidence. The dorsal color is nearly uniform.

Distribution: The records for Thailand suggest that the species is widespread, probably occurring in most of the continental portion of the country and at least a part if not all of the peninsula. I have taken or examined specimens from the following provinces: Chaiyaphum, Chiang Mai, Rat Buri, Nakhon Phanom, Udon Thani, Chon Buri, Sara Buri, and Phatthalung.

Outside of Thailand the species is known in southern China, Indo-China, Hongkong, Hainan, and Formosa. It has also been found in Malaya but apparently in only a few places (Pahang and Pulao Tioman).

Mabuya rugifera (Stoliczka)

FIG. 64

Tiliqua rugifera Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, 1870, p. 170, pl. 10, fig. 3 (type-locality, Camorta, Nicobar Islands).

Mabuia rugifera: Boulenger, Catalogue of the lizards of the British Museum, vol. 3, 1887, p. 184; The fauna of British India, Ceylon and Burma; Reptilia and Batrachia, 1890, p. 190; Flower, Proc. Zool. Soc. London, 1899, p. 645; M. Smith, Ann. Mag. Nat. Hist., ser. 9, vol. 18, 1926, p. 78.

Mabuya rugifera: M. Smith, The fauna of British India, including Ceylon, and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, p. 273.

Euprepis (*Tiliqua*) *percarinatus* Peters, Mon. Akad. Wiss. Berlin, 1871, p. 571 (type-locality, Matang, E. Java).

Euprepis percarinatus borneensis Peters, Monatsb. Akad. Wiss. Berlin, 1871, p. 572 (type-locality, Sarawak, Borneo).

Mabuia quinquecarinata Werner, Verh. Zool.-bot. Ges. Wien., vol. 46, 1896, p. 12 (type-locality, Sumatra).

Diagnosis: Prefrontals separated; interparietal very small, with parietals in contact behind it; one pair of nuchals; lower eyelid

scaly; dorsal scales generally quinquecarinate, laterals sometimes with seven strong keels; 24-28 scalerows around body; five to seven longitudinal greenish-white lines on body (or none); lines often broken.

Description of species (from No. 1526, La Doo Tin Mine, Bendang Stah, Yala): Rostral two and one-half times as wide as high, rather



FIG. 64—*Mabuya rugifera* (Stoliczka). Br. Museum No. 1934.7.6.1, Gunong Kledang, 2646 ft. Perak; about natural size.

truncate posteriorly, broadly in contact with frontonasal; small slender supranasals widely separated; frontonasal about as broad as long, or a little broader, forming suture with frontal; prefrontals separated; frontal seven-sided, longer than its distance from tip of snout, approximately as long as distance to nuchal; two frontoparietals; interparietal small; parietals large, in contact behind interparietal, keeled posteriorly; nuchals small, more or less distinct; nostril in single nasal; no postnasal; first loreal twice as high as wide; second loreal lower, one and one-half times as long as high; two presuboculars; supralabials 9-9, sixth three times as long as other supralabials; four supraoculars, second touching or somewhat separated from prefrontal; six clearly defined supraciliaries, separated from rather large palpebral scales by three or more rows of fine granules; lower palpebrals smaller than upper, bordering a series of three or four larger shields on eyelid; latter separated from sixth labial by five rows of small granules; three or four superimposed pairs of temporal scales strongly keeled; auricular opening a longitudinal oval with some tiny lobules above.

Mental with labial border greater than that of rostral, truncate behind, followed by a broad postmental; this in turn followed by four pairs of chinshields; first pair forms a suture, second and third separated by one scale, fourth small, last two pairs not touching labials; seven infralabials.

Twenty-four scalerows about middle of body, dorsal and lateral scales subequal, with three to six strong keels, some of which form mucrones, leaving scales notched posteriorly; 24 scales about neck; 31 transverse rows from nuchals to above vent; eight ventral rows smooth; a pair of large preanals, flanked by two small lateral scales; subcaudal scutes a little wider and larger than adjoining scales.

Arm moderate; leg adpressed, reaches beyond elbow of arm; small irregular scales in axilla; 19 lamellae under longest finger, proximally flat, wide distally, compressed; a prominent tubercular scale on wrist; toes with lamellae similar to those on hand, about 24 under fourth toe.

Color in life: Above dark-olive; sides of head somewhat brownish; labials yellowish cream; venter greenish white; blackish under digits.

Measurements in mm.: Snout to vent, 59; tail broken; width of head, 9; length of head, 14; snout to arm-insertion, 20.2; axilla to groin, 30; arm, 18.5; leg, 27.

Variation: A postnasal may be present, the sixth labial may be divided by a vertical suture; the dorsal scales usually have five

keels, with seven keels on sides. In the described specimen occasional scales may have six keels dorsally and laterally, while the outer keeled rows may have only three or four; the species may have five to seven greenish-white lines or the lines may be broken into a series of spots. Other specimens may be uniform olive; these are usually if not invariably males.

Distribution: *Rugifera* has been reported in Thailand only at Benang Stah, Yala. My specimens come from the same anphur (county). Two other specimens seen, escaped. They were along the edge of a tiny rivulet.

Outside of Thailand the species is known in the Nicobar Islands (the type-locality), Malaya, Sumatra, Java, and Borneo.

Remarks: The figure shows a specimen of the lined phase, B.M. No. 1934.7.6.1, from Gumong Kledang, 2646 ft. Perak the adjoining Malay state. This differs from the described specimen as follows: There are 26 scalerows about the middle of the body; the first loreal is broken transversely on one side; the second supraocular is separated from the prefrontal; five supraciliaries present; no nuchals; while 26 lamellae are present on the underside of the fourth toe.

Mabuia multifasciata (Kuhl)

FIG. 65

Scincus multifasciatus Kuhl, Beitr. Zool. und Vergl. Anat., 1820, p. 126 (no type-locality recorded; fixed by Taylor and Elbel, Batavia, Java).

Mabuia multifasciata: Fitzinger, Neue Klassifikation der reptilien . . . 1826, p. 52 (type-locality, Java); Boulenger, Catalogue of the lizards in the British Museum (Natural History), vol. 3, 1887, p. 186; Anderson, Journ. Linn. Soc., vol. 21, 1889, pp. 334-335; Boulenger, The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, pp. 191-193; Laidlaw, Proc. Zool. Soc. London, 1901, pt. 1, p. 310; Mocquard, Les reptiles de l'Indo-Chine, 1907, p. 38; Boulenger, A vertebrate fauna of the Malay Peninsula, . . . Reptilia and Batrachia, 1912, p. 84; Flower, Proc. Zool. Soc. London, 1899, p. 645; Annandale, Journ. Asiat. Soc. Bengal, ser. 2, vol. 2, 1905, p. 141; Smith and Kloss, Journ. Nat. Hist. Soc. Siam, vol. 1, no. 4, 1915, pp. 242-243 (varieties and localities); M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, Dec. 1916, p. 156 (peninsular Siam); *ibid.*, June 1916, p. 55; de Rooij, Reptiles of the Indo-Australian Archipelago, vol. 1, Lacertilia, Chelonina, Emydosauria, 1915, pp. 162-163, fig. 69; Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 420; Pope, Bull. Amer. Mus. Nat. Hist., vol. 58, 1929, p. 377; Kopstein, Treubia, vol. 11, 1930, p. 307; Weekes, Proc. Linn. Soc. New S. Wales, vol. 55, 1930, p. 560.

Mabuia multifasciata multifasciata: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 268-269.

Euprepes sebæ Duméril and Bibron, Erpétologie générale, vol. 5, 1839, p. 692 (type-locality, Batavia, Java [restricted by M. Smith, 1935]).

Tropidolepisma macrurus Bleeker, Naturg. Tijdschr. Nederl. Ind., vol. 20, 1860, p. 328.

Mabuia monticola Annandale, Journ. Asiat. Soc. Bengal, ser. 2, vol. 1, 1905, p. 143.



FIG. 65.—*Mabuya multifasciata* (Kuhl). No. 33539, Kanchanaburi, Kanchanaburi province, Thailand. Actual snout-vent length, 90 mm. Total length, 248 mm.

Plestiodon sikkimensis Gray, Ann. Mag. Nat. Hist., ser. 2, vol. 12, 1853, p. 388 (type-locality, Sikkim).

Diagnosis: Supranasals touching or slightly separated from each other; a postnasal; prefrontals in contact; first loreal not higher than second; no disc in lower eyelid. Scales usually tricarinate, rarely more; 30-34 scalerows about middle of body; usually dim, dark, dorsal lines between scalerows; sides dark brown usually with numerous ocelli.

Description of species (from No. 33539, taken at Kanchanaburi): Rostral not quite as broad as high, touching frontonasal narrowly; supranasals narrowly separated, each touching postnasal and first loreal; frontonasal much broader than long; prefrontals broadly in contact; frontal as long as its distance from tip of snout; four supraoculars, second, touching prefrontal, largest; frontoparietals paired (one broken abnormally), interparietal small, not enclosed by parietals; a pair of enlarged nuchals; nostril in posterior part of nasal separated from supranasal and postnasal by a very narrow rim; anterior loreal no higher and but little smaller than second; first touching one supralabial, second, two; three very small preoculars; two presuboculars; six supraciliaries; three postsuboculars; three anterior and three secondary temporals; seven supralabials, fifth elongated, below eye; six infralabials; mental border on mouth longer than rostral border; one broad postmental; first chinshields broadly in contact, second pair separated by one scale, third pair elongate separated by five scales. Lower eyelid with several semi-opaque scales; ear-opening large with four or five auricular lobules on anterior border. Dorsal scales distinctly tricarinate, not striated or forming continuous lines; temporal scales nearly smooth; lateral scales tricarinate growing less distinctly keeled low on sides; ventral scales smooth. Caudal scales keeled on anterior half of tail, growing smooth distally. Scalerows about middle of body, 34; around neck, 32; 45 transverse rows, between parietals and a point above vent; 90 subcaudals, median row wider than adjoining rows.

Arms and legs well developed, the leg reaching nearly to axilla when adpressed; 17 scales under fourth finger, 19-20 under fourth toe, scales compressed, with keels, small tubercles, or thickenings, near their bases.

Color in life: Above, olive-gray with narrow blackish lines bordering scalerows; somewhat indefinite light olive or yellowish-olive dorsolateral line; on side broad brown stripe, darkest on edges of dorsolateral light lines and growing light brown to gray-brown low

on sides; stripe with numerous black and greenish-cream ocelli continued onto tail; below on venter, grayish or greenish-white with a wash of yellow; labials greenish-white.

Measurements in mm.: Snout to vent, 90; tail, 158; head length, 23; head width, 13.7; snout to ear, 18; snout to arm-insertion, 34; axilla to groin, 48; arm, 28.5; leg, 39.8.

Variation: Rarely the supranasals touch, separating the rostral from the frontonasal. The postnasal seemingly is invariably present. The temporal scales may show low keels. Rarely five keels may be counted on dorsal scales, the lateral scales often showing low or indefinite keels. The scalerows vary between 30-34 around the body; the hind limb varies in its reach with age. Malcolm Smith records 125 mm. snout to vent length, and 180 mm. as tail length for the species. The male during the breeding season has a large orange or red-orange blotch in the axillary region, which may extend to the groin.

Distribution: The species is ubiquitous in Thailand, having been taken in practically every province where collecting has been done. Outside of Thailand the species spreads its range from southern China, Indo-China, Northeastern India, Assam, Burma, to Malaya, and the Indo-Australian Archipelago.

Remarks: This species has been treated by Malcolm Smith as having *Mabuya rudis* as a subspecies. Anyone who has found the two together in the field will probably not subscribe to this treatment. He states (Smith, 1935, p. 269) "This form [*M. m. rudis*] occurs also on Sumatra and on Mentawai Islands but not to the exclusion of the typical form."

Thus throughout much of the range *rudis* occurs with *multifasciata*. I have taken both together in Mindanao and certain of the Sulu Islands. Smith states that *M. multifasciata* is apparently not found on Borneo. He has overlooked a paper de Rooij (1915, p. 163) that reports *multifasciatus* from several Bornean localities, and also reports *rudis* from several of the same localities.

Multifasciata is an ovoviviparous species producing four to eight young at a time. It is primarily a lowland form.

Mabuya macularia (Blyth)

Euprepis macularia Blyth, Journ. Asiat. Soc. Bengal, vol. 22, 1853, p. 652 (type-locality? Rangpur, Bengal); M. Smith, The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 264-266.

A considerable number of small forms of *Mabuya* have been

described from India. These include *brevis* Günther, *subunicolor* Blanford (as a variety), *madaraszi* Mehely, *dawsoni* Annandale, and *allapallensis* Schmidt.

Concerning these Doctor Smith (*l. c.*) says: "When a good series of this lizard from different parts of its range are compared it will be seen that five more or less distinct geographical forms can be distinguished. Aberrant individuals—those that resemble forms from one area but occur in another area—are to be found, but on the whole the combination of color-pattern and morphological characters can be relied upon."

The above listed species are placed in synonymy by Dr. Smith and then he proceeds to distinguish five "forms" one of which, No. 5, is reported as follows:

"Like no. 1 but the leg longer, sometimes reaching to the axilla, and with the light lateral stripes more distinct; throat sometimes spotted with black. Examples of this form from the islands of the Gulf of Siam (Koh Kut and Koh Phai) have 30, 32, or 34 scales round the body. From snout to vent, 65 mm."

There are three forms in Thailand that I have encountered which I consider subspecies of *macularia*. It is probable that the typical form does not occur here.

Mabuya macularia quadrifasciata Taylor and Elbel

FIGS. 66, 67

Mabuya macularia quadrifasciata Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1103-1105 (type-locality 1780 m. elev. Phu Nam Lang (Mt.) Ban Khok, Na Phung, Dan Sai, Loei, Thailand).

Diagnosis: Four dark dotted dorsal lines on back; scales on chin and throat with brown borders; most scales of sides each with a lighter area; an axillary pit or pocket; anterior loreal usually divided; area of specialized "chiggermite" scales on leg above ankle.

Description of subspecies (from CU. No. 2679, Phu Kading (Mt.) Loei province): Rostral considerably wider than high, well visible on top of snout, forming a curving suture with frontonasal; supranasals slender separated, as long as nasal; frontonasal as wide as long forming a curving suture with frontal, touching first loreal and supranasal laterally; prefrontals moderately large, separated; frontal elongate, slender, its length greater than its distance from tip of snout, much longer than its distance from nuchals; paired frontoparietals; interparietal not enclosed by short parietals; a pair of nuchals; nasal divided; no postnasal; anterior loreal higher and shorter than second; two preoculars; one pre-subocular; temporals,

3 + 3; seven supralabials, fifth largest elongate, below eye; lower eyelid sealed; six supraciliaries; four supraoculars, second not in contact with prefrontal; mental a little wider than rostral; large azygos postmental; two pairs of chinshields both separated from each other but touching infralabials; 30 scalerows around middle of body; ear moderate with two or three lobules; head scales, except nuchals, smooth; dorsal scales with five (usually) or six keels, median ones a little farther apart than outer; lateral scales with six or seven keels; scales on arms and legs with two or three keels; scales on chin, venter, subcaudal area, and underside of



FIG. 66.—*Mabuya macularia quadrifasciata* Taylor and Elbel. Type. EHT-HMS No. 31802, Namlang Mt. 1780 m. Loei province, Thailand. Actual snout-vent length, 57 mm.

limbs smooth; subcaudal scales widened except at base; tip of tail missing; six preanal scales moderately enlarged; a small chigger-refuge above ankle; eleven lamellae under two median fingers; 14 under longest toe. Limbs overlap when adpressed.

Color: Male. Above olive-brown with indefinite small black spots, each with tiny brown or whitish dots; a black stripe along

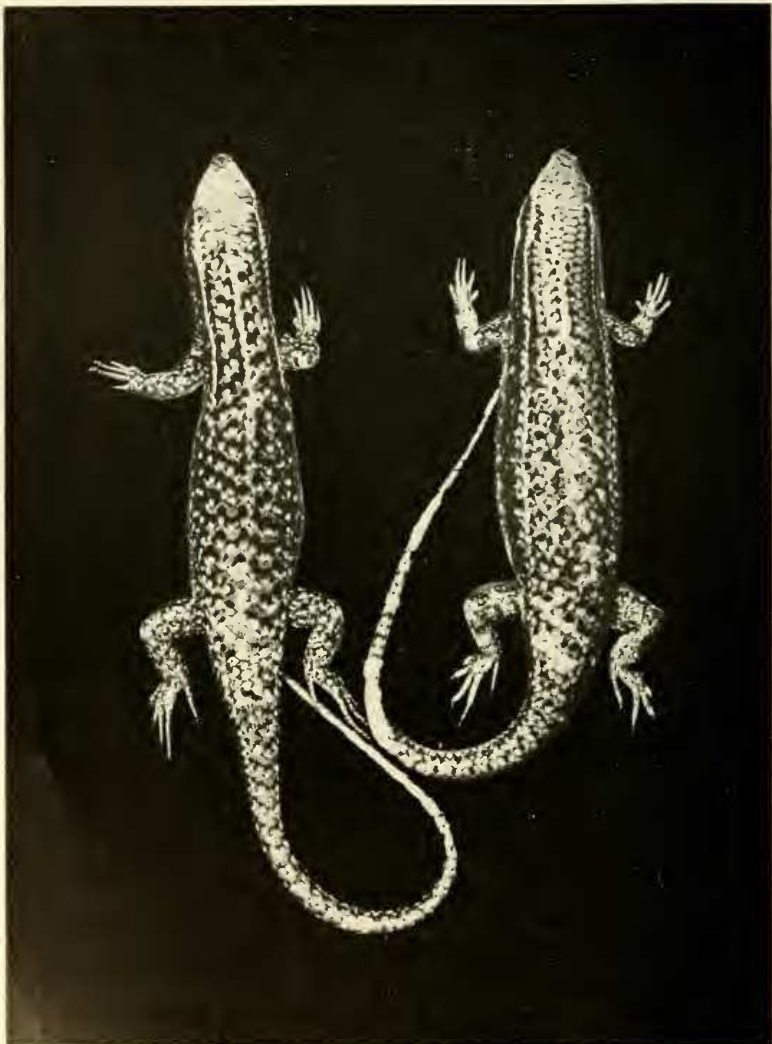


FIG. 67.—*Mabuya macularia quadrifasciata* Taylor and Elbel. Left figure No. 2679 ♂. Actual total length, 147 mm. Right figure No. 2678 ♀. Actual total length 138 mm. Both from Phu Kading, Loei province, Thailand.

side of head and body bordered by indefinite light dotted lines anteriorly. Sides of body and tail with very numerous small irregular black spots each with a white or bluish-white dot. Ventral scales of chin and throat bluish, most with a dark border; ventral scales ultramarine, smoky along edges; subcaudal area very light bluish gray.

Measurements in mm.: Nos. 2679 ♂, 2678 ♀; snout to vent 57, 58; tail 90 (tip missing), 80 (part regenerated); snout to arm-insertion, 22, 20; axilla to groin, 27, 30; width of head, 10.2, 10; length of head, 15, 14.5; arm, 15, 16; leg, 23, 22.

Variation: The female differs in having most of the dorsal scales with black spots tending to form rows anteriorly but no white dots; the cream-white dots on sides are fewer, smaller and less conspicuous than in the males; a dorsolateral light line (or row of white dots) from eye to midway on body; another line from below eye, at least to near insertion of arm; a dark lateral stripe from eye along side of body; sutures of labials black.

Distribution: This form is probably confined to the mountains of the eastern part of the Khorat Plateau.

Mabuya macularia postnasalis Taylor and Elbel

Mabuya macularia postnasalis Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1105-1106 (type-locality 2100 m. elev., Phu Lom Lo, Kok Sathon, Dan Sai, Loei province Thailand).

Diagnosis: A postnasal present; a specialized group of scales on leg above ankle forming a chigger-mite refuge; no axillary "chigger pocket." A dark lateral band present bordered below by a light line; a few scales on rump and those on lower lateral rows with small blackish spots some of which may have a tiny cream spot in center; one or two presuboculars.

Description of subspecies: A small species, limbs overlapping when adpressed; rostral and frontonasal touching; prefrontals narrowly separated from each other and touching the second supra-ocular; supranasals small, separated; anterior loreal single, higher but narrower than second; a true postnasal present; no scale behind supranasal; one presubocular; usually four enlarged palpebral scales; frontal about equal to its distance to the end of the snout, shorter than combined length of parietals; one pair of nuchals; seven supralabials; three primary and three secondary temporals; frontoparietal suture two thirds of the length of the scales, longer than the interparietal which separates parietals; eight infralabials; mental border on mouth wider than that of rostral; five supraciliaries; four supra-

oculars, two touching frontal; 30 scalerows around body; 15-16 lamellae under fourth toe; no shallow pocket in axilla; tail complete with 71 subcaudals; ear about half size of a dorsal scale, with some tiny lobules bordering the anterior edge.

Area above foot on leg with specialized pointed scales strongly infested with chigger-mites; scales of body three or five-keeled (sometimes seven-keeled), becoming four-keeled on base of tail the two inner keels stronger and a little wider apart, the median keel absent; scales not or scarcely denticulate behind; scales on sides of neck, on arm and leg, with two or three keels, more distinct on neck and leg. Ventrals smooth and lower lateral scalerows smooth or nearly so.

Two pairs of enlarged chinshields touching labials, first pair very narrowly separated, second pair separated by a scale; third chinshields small, separated from labials by an elongate scale; median preanals larger than outer ones; subcaudals slightly wider than adjoining scales.

Color: Above brown or brown-olive with a very dim darker lateral band on side, most distinct on neck, bordered above by a slightly lighter line scarcely visible behind neck; there are eight scales on back between darker bands; numerous small dark equal-sized flecks scattered on rump, each with a tiny lighter middle part; along lateral stripe all scales with a discrete black spot; below this

Measurements in mm. of *Mabuya macularia postnasalis*

NUMBERS	40109	40110	40111	40112
Length, snout to vent	58	55	56	55
Tail		80	85	72 broken
Head length	15.5	14	15	
Head width	10.5	10.2	10.2	
Snout to ear	12.3	11.2	12	
Snout to arm	20.5	19.8	18	
Axilla to groin	29	25.5	24.4	25.2
Arm	19	18.2	17	16.8
Leg	25.5	22.5	23	23
Postnasal	Yes	Yes	Yes	Yes
Prefrontals separated	Yes	Yes	Yes	Yes
Prefrontal touches 2nd supraocular	Yes	Yes	No	Yes
First chinshields separated	Yes	No	Yes	No
Supraciliaries	5	5	5	5
Axillary pocket	No	No	No	No
Chigger "area" on leg	Yes	Yes	Yes	Yes
Scalerows	30	30	30	30

stripe all scales with black dots tending to form rows; one or two similar lines of dots along tail; a distinct light line from tip of snout along supralabials below ear (but including lower edge) and continuing very dimly along side below dark stripe; chin without dark marks; seven median ventral rows of scales uniform, probably white or yellow in life.



FIG. 68.—*Mabuya macularia malcolmi* Taylor and Elbel. No. 34701, Rice Experiment Station, Phatthalung, Phatthalung province. Actual total length, 122 mm.

Mabuya macularia malcolmi Taylor and Elbel

FIGS. 68, 68a

Mabuya macularia malcolmi Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, 1107 (type-locality, Phu Phak Khi Nak (Mt.), near Ban Nam Yen, Kok Sathon, Dan Sai, Loei province, Thailand).

Diagnosis and description: No trace of an axillary pit, no post-nasal, but posterior part of nasal somewhat narrowed; frontal shorter than combined parietal but equal or a little greater than its distance from snout tip, wider than the frontonasal, but touching it; second loreal relatively short, much less than twice as wide as first loreal;



FIG. 68a.—*Mabuya macularia malcolmi* Taylor and Elbel. No. 2268, Doi Suthep Thailand, elev. 100 meters. About natural size.

a chigger mite refuge on the lower part of leg; leg adpressed reaches to elbow; first chinshields separated mesially; transverse rows of scales, parietal to above vent, 38; from mental to vent, 47; 30 scalerows about body.

Color: Above generally olive, each dorsal scale with a slightly darker central area; head darker olive; a dorsolateral stripe on side of head and neck continued on to the anterior part of body, and bordered below by a lighter line from the upper lip; four preanal scales whitish.

Genus *DASIA* Gray

Dasia Gray, Ann. Mag. Nat. Hist., vol. 2, 1839, p. 331 (type of genus, *Dasia olivacea*).

Diagnosis: Arboreal skinks, the palatine bones meeting on palate mesially; pterygoids in contact; palatal notch not reaching level of eyes; maxillary teeth conical; usually one or two pterygoid teeth; nostril pierced in a nasal; supranasals present; prefrontals, frontoparietals, and interparietals distinct; ear-opening small; tympanum deeply sunk; limbs well developed, pentadactyl.

Only a single species is known to occur in Thailand, and this only in the southern peninsula area.

A second species, a form with three keels, occurs in Malaya and some of the larger islands of the Indo-Australian Archipelago. This, too, may be looked for in Thailand.

Dasia olivacea Gray

FIG. 69

Dasia olivacea Gray, Ann. Mag. Nat. Hist., vol. 2, 1838, p. 331 (type-locality, Penang, Malaya); Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 21; M. Smith, A fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 277-278.

Euprepes olivaceus: Günther, Reptiles of British India, 1864, p. 80, pl. 10, fig. 17.

Tiliqua olivacea: Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, 1870, p. 172.

Lygosoma olivaceum: Boulenger, Catalogue of the lizards in the British Museum, 2nd ed., vol. 3, 1887, p. 251; The fauna of British India . . . Reptilia and Batrachia, 1890, p. 187; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore . . . , Reptilia and Batrachia, 1912, p. 91 (*part.*); M. Smith, Journ. Siam. Nat. Hist. Soc. Siam, vol. 4, 1920, p. 96 (Pulo Condore).

Euprepes ernstii Duméril and Bibron, Erpétologie générale . . . , vol. 5, 1839, p. 696 (type-locality, Java).

Diagnosis: A rather large skink (115 mm. snout to vent), greenish to olive with a series of 13 transverse markings consisting of irregular rows of greenish white dots each edged in blackish olive. A pair of small supranasals, widely separated; prefrontals touching or



FIG. 69.—*Dasia olivacea* Gray. No. 34432, Bukit Besar Mt. near Na Pradoo, Pattani. Actual length, snout to vent, 108; total length, 265 mm.

narrowly separated; four supraoculars; preanals not or but slightly enlarged; interparietal not enclosed by parietals; one pair of nuchals; 28-30 scalerows around body.

Description of species (from 34432 Bukit Besar, Na Pradoo, Patani): Rostral broader than high, broadly visible above, in contact with frontonasal; latter distinctly broader than long, barely in contact with frontal; prefrontals large, narrowly separated; frontal as long as its distance from end of snout, about equal to length of combined parietals; pair of small supranasals, widely separated; nostril in single nasal, which touches only one labial; two elongate loreals, posterior longest; two presuboculars; four supraoculars, two touching frontal; paired frontoparietals; parietals wide but rather short, not enclosing interparietal posteriorly; pair of nuchals; seven or eight supraciliaries; four or five enlarged translucent scales on lower eyelid; pair of anterior temporals; seven supralabials, fifth longest below eye; six infralabials; mental large, its border on lip larger than that of rostral; postmental (abnormally) divided; first chinshields in contact, second pair separated by a scale.

Scales on body rounded, imbricate; 30 scalerows about middle of body; scales on neck smooth, gradually developing keels, those on latter half of body with three major keels and often with one or two other keels on each side; on tail, keels present only at base; scales on sides of body smooth; scales on limbs keeled, strongly so on legs; preanals not or but slightly larger than adjoining scales; lamellae under digits widened, flattened on basal parts, 16 or 17 under longest fingers; 19 under fourth toe; five or six enlarged flat tubercles border heel (yellow in color); 85 subcaudals, most of median series widened.

Ear very small; head rather pointed; tail slender, tapering to a narrow tip; arms and legs overlap length of hand when adpressed.

Color in life: Above greenish with some bronze scales in dorso-lateral areas; series of thirteen transverse bands of small irregular greenish-white ocelli bordered by black and extending low on sides; venter bluish green becoming more bluish in preservation; palms and soles amber; blackish on tail, with flecks of greenish white and brown, the distal portion of undersurface olive-brown, basal portion greenish or bluish green. Top of head dark-olive with four pairs of black dashlike marks in supraocular region.

Measurements in mm.: Snout to vent, 108; tail, 157; width of head, 19; length of head, 25; snout to ear, 21; snout to arm-insertion, 39; axilla to groin, 52; arm, 27; leg, 34.

Variation: Malcolm Smith (1935) notes the following variations: scalerows 28-30; the dorsal scales may have three, five, or seven keels. The lamellae under the fourth toe vary between 17 and 22.

The young specimens are dark, often nearly black, with narrow irregular silvery transverse bars on dorsum.

Distribution: Specimens of *Dasia olivacea* have been taken in the provinces of Yala, Pattani, and Narathiwat in Thailand. It also occurs on the island, Pulao Panjang, Thailand.

The species has been taken in Cambodia, Malaya, Borneo, Sumatra, Java, and the Philippines.

Remarks: The species is largely arboreal in habit. The specimen here described was captured in a tree growing near the base of Bukit Besar (mountain) close to Na Pradoo, Pattani province. I am convinced that previous authors have confused more than a single species under this name; a five-keeled form is reported from Pulo Condore (off coast of Viet Nam) and I have seen specimens of a species in Malaya having three-keeled scales. The latter differs also in numerous other characters and occurs together with the species I consider to be *olivacea*.

Genus RIOPA Gray

Riopa Gray, Ann. Mag. Nat. Hist., first series, vol. 2, Jan. 1839; p. 332 (type *Lygosoma punctata*).

Diagnosis: The chief features of *Riopa* are as follows: Supranasals present, separate or sometimes fused or partially fused with nasal; frontoparietal single or paired; prefrontals present, separated or touching; tympanum small, deeply sunk; eyelids reduced in species with elongated bodies; lower eyelid scaly or with a transparent disc. Palatine bones meet on midline of palate; pterygoids touching anteriorly, palatal notch not reaching to level of eyes.

This genus has six known representatives in Thailand, all belonging to the section of the genus having the lower eyelid covered with scales, lacking a transparent disc.

The genus is widespread, some fourteen species occurring in southern and southeastern Asia. It also occurs in Polynesia, Australia and Africa.

KEY TO SPECIES OF RIOPA IN THAILAND

- | | |
|--|---|
| 1. A single frontoparietal | 2 |
| Two frontoparietals | 4 |
| 2. Limbs widely separated, the arm contained in axilla-to-groin distance | |
| 7-9 times | 3 |

- Limbs less widely separated, the arm contained in axilla-to-groin distance 3 to 4 times; 28-30 scalerows around body; 56-60 scales in a row between parietals and a point above vent. Maximum length known, 41 mm. *frontoparietalis*
3. Arm-length, in axilla-to-groin distance 9 times; 40-42 scales about middle of body; 143 scales in a row between parietals and a point above vent *haroldyoungi*
- Arm-length in axilla-to-groin distance approximately 7.25 times; 30-34 scalerows about middle part of body; 88-98 scales in a line between parietals and a point above vent *isodactyla*
4. Limbs when adressed widely separated; the arm length in axilla-to-groin distance approximately 5 times; 32-34 scalerows about middle of body; 60-63 scales in a row from parietals to above vent, *koratense*
- Limbs when adressed separated by a distance about equal to length of leg; arm-length in axilla-to-groin length 3-3.5 times 5
5. Scalerows about middle of body 26-28; dorsal scales distinctly keeled, no black dorsolateral line or indistinct lineation on dorsal scales, *herberti*
- Scalerows about middle of body 28-30; dorsal scales smooth (rarely dimly keeled); snout to vent 70 mm.; a blackish dorsolateral line, *howringi*

Riopa koratense (M. Smith)

FIG. 70

Lygosoma koratense M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, May 1917, pp. 222-223, pl. —, fig. 1, 1a, 1b (type-locality "Lat Bua Kao, Dong Rek [Dong Paya Fai] mountains").

Riopa koratense: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia; vol. 2, Sauria, Feb. 7, 1935, p. 314.

Diagnosis: Distance between end of snout and arm-insertion, twice in axilla-to-groin distance or slightly more; internasals partially fused with nasal; scales smooth in 32-34 scalerows at middle of body; tail shorter than head and body. Distance between adpressed limbs about equal to length of leg.

Description of species (from No. 33374, near Muak Lek, Sara Buri, but in Nakhon Ratchasima): Rostral wider than high, part visible above considerably longer than suture between supranasals; latter scales fused to nasals anteriorly; frontonasal about twice as broad as long touching first loreal; prefrontals small, widely separated, leaving a broad suture between frontal and frontonasal; frontal a fifth longer than its distance from tip of snout; frontoparietal divided; interparietal small enclosed behind by parietals; no enlarged nuchal scales; nostril in lowest part of the combined nasal-supranasal scale, a suture running forward from first loreal to above nostril; first loreal higher and shorter than second; a pair of unequal



FIG. 70.—*Riopa koratense* (M. Smith). No. 33374, near Muak Lek, Sara Buri, but in adjoining province, Nakhon Ratchasima. Actual snout-to-vent length, 106 mm.; tail, 95 mm.

preocular scales, one presubocular; four supraoculars second largest; six supraciliaries first and last largest; eyelid with two rows of scales besides palpebrals; two postsuboculars.

First labial largest, thickened somewhat, as are other scales on front of snout; eight supralabials, that under eye (fifth) only slightly enlarged; two primary temporals, three secondary, the upper primary largest.

Mental thickened, with a much longer labial border than rostral; seven infralabials; a large azygos postmental; first chinshields in contact; second pair separated by a scale; third pair, not clearly differentiated, separated by several scales.

Ear-opening very small ($1\frac{1}{2} \times 1$ mm.) with two small lobules projecting from anterior border; 28 scalerows around neck; the scales subequal; 32 scalerows about middle of body; 63 transverse scale-rows between parietals and a point above vent; 71 subcaudals the terminal scale sharply pointed. Vent bordered by seven scales, not or scarcely differentiated from adjoining scales.

Limbs short, pentadactyl; digits with lamellae compressed, forming a more or less continuous keel; nine scales under two longest fingers, 13-14 under fourth toe; tail tapering rather suddenly to a point.

Color in life: Violet-brown, the scales edged behind with darker brown with an indefinite darker spot at base; sides lighter than dorsum, while scales on venter grayish-white, somewhat darker than this under tail. Scales of head with slightly darker edges.

Measurements in mm. of *Riopa koratense*

	Type	33374	33380
Snout to vent.....	105	106	101
Tail.....	95*	95	93
Snout to ear.....		15	14
Snout to arm.....		30	30
Axilla to groin.....		64	61
Length of head.....		19	18
Width of head.....		13	13
Width of body.....		19	17
Arm.....	15	15	16
Leg.....	24	25	24

* Reported incomplete; the tails are complete on the specimens reported by me.

Variation: The scalerows about body vary between 32 and 34.

Distribution: M. Smith has reported four specimen from the type locality at Lat Bua Kao in Nakhon Ratchasima on the Eastern

slope of the Dong Rek Mountains. My three specimens are from the vicinity of Muak Lek.

Remarks: The type description records that the flanks are pale greenish yellow, and the venter is yellowish white; it also states that the nostril is between two nasals but this latter statement is correctly interpreted in a later work (Smith, 1935, p. 314).

The species is a burrowing form, one having been taken from under a flat rock, the other dug out of debris. Both of my specimens were taken about one mile west of Muak Lek in low limestone mountains. This locality is actually in Nakhon Ratchasima province while Muak Lek is in Sari Buri province.

Riopa isodactyla (Günther)

FIG. 71

Eumeces isodactylus Günther, Reptiles of British India, 1864, p. 93, pl. 12, fig. A (type-locality, Cambodia).

Lygosoma isodactylum: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 339; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, 1914, pp. 127-128, fig.; *ibid.*, vol. 2, 1916, p. 56.

Riopa isodactyla: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 317-318 ("Central Siam between Ayuthia and Paknam Po, Nakhon Sawan").

Squamificilia [isodactyla] Mittleman, Smith. Misc. Coll., vol. 117, 1952, p. 9.

Diagnosis: Frontoparietal single; 88-98 transverse scalerows between parietal and a point above vent; internasal fused with nasal anteriorly; 30-34 longitudinal scalerows around body; ear-opening partially covered with scales; scales cover lower eyelid; first supralabial largest; legs small, pentadactyl, three median fingers subequal; three median toes subequal; tail somewhat shorter than head and body; eight dorsal scalerows, each scale dark-edged; a light band on occiput widening laterally; dark nuchal band terminating at ear-opening; remainder of side and venter yellowish.

Description of species (from No. 33185, Sara Buri): Head rather flat above and rather narrowed at tip of snout; rostral about as high as wide, well visible above forming narrow suture with frontonasal thus separating supranasals; supranasals fused anteriorly with nasals; no postnasal; frontonasal wider than long, touching single loreal laterally; prefrontals small, widely separated; frontal little longer than wide, little longer but less wide than single frontoparietal (partially divided anteriorly); interparietal small, enclosed posteriorly by large elongate parietals; latter bordered by three temporals and two small median scales; no enlarged nuchals.

Anterior loreal higher but narrower than second; latter little



FIG. 71.—*Riopa isodactyla* (Günther).
No. 33185, near Sara Buri, Sara Buri province, Thailand. Actual total length, 148.5 mm.

longer than high; two preoculars; five or six suboculars; lower eyelid with seven scales, without a transparent disc; seven supraciliaries, last larger than first; four supraoculars, first two touch frontal; prefrontal touches first supraocular.

Seven supralabials, first largest, fourth, fifth and part of sixth below eye, subequal; three anterior temporals, upper touching parietal; four secondary temporals; mental much wider than rostral; six infralabials; an undivided postmental; first pair of chinshields in contact; second pair separated by one scale, third pair by three scales, but not touching infralabials.

Ear-opening separated from mouth-angle by a series of six or seven scales, almost obliterated by two large scales which cover much of the opening; tympanum deeply sunk; scales smooth, shiny, imbricate, in 32 longitudinal rows around body, and 98 transverse rows between parietals and a point above vent; 83 subcaudal scales, median not enlarged.

Arms and legs small, pentadactyl, clawed, distance between adpressed limbs equal to more than three times length of arm. Three middle fingers subequal; three middle toes subequal, the lamellae compressed, keeled, nine or ten under fourth toe; preanal region bordered by six scales.

Color in life: Head black on top with a few lighter points in front and behind interparietal and on front border of frontal; supralabials and infralabials each with a black spot; narrow light band across occiput, widening much on sides; black transverse band on occiput running between ears, narrowing laterally; back dark olive, scales strongly edged with black; sides similar except for a few fine punctations (more prevalent on sides of tail); chin, venter, and underside of tail yellowish; black spot on postmental with very few fine flecks on chinshields; underside of digits blackish.

Measurements in mm.: Snout to vent, 82.5; tail, 66; snout to ear, 10.3; snout to foreleg, 20; axilla to groin, 58; arm, 8.1; leg, 12.4; head length, 11.7; head width, 7.7; body width, 7.7.

Variation: The number of scalerows varies between 30 and 34, the type having only 30. The amount of black spotting varies considerably in specimens from the same or nearby localities.

Distribution: The species is known in Thailand from the provinces of Ayutthia, Sara Buri, and Nakhon Sawan.

The type-locality is Cambodia, and presumably is not known elsewhere outside of Thailand.

Malcolm Smith reports on nine specimens: Stone quarries at Sanam Cheng (north of Lopburi [2]); Lopburi [1]; Sam Kok [2]; Chong Kae (beneath stacks of firewood in the station yard [4]).

Remarks: The specimen described was taken from under a small log lying in an open field. It was very active and moved in a snake-like manner, the legs apparently not being used when moving fast.

A figure is given by M. Smith (1914). His color description follows: "Above dark yellowish thickly powdered with very dark brown, this color often confluent and forming patches. In one of these, the patches were so extensive as to practically obscure the ground color. Sides with a dark edge to each scale, forming oblique lines upwards and backwards. Below, pale yellow or yellowish-white speckled irregularly with brown. In the only half-grown specimen I obtained the belly was a uniform pale yellowish color. Labials, the first excepted, barred with yellow and brown alternately."

Riopa haroldyoungi Taylor

FIG. 72

Riopa haroldyoungi Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, p. 242-244, fig. 12 (type locality, Doi Suthep, Chiang Mai province).

Diagnosis: Skink with an elongate body, distance between tip of snout and insertion of arm contained in axilla-to-groin measurement about three and one-third times; length of arm in axilla-to-groin distance about nine times; ear-opening small distinct; nostril in nasal, almost bordering supranasal; rostral, first supralabials, mental, first infralabial, nasals, and supranasals somewhat thickened, bluish to ultramarine in color; first supralabial twice as large as three subsequent supralabials.

An ivory-white ring about head behind parietals; body with 32 irregular transverse light bands often broken, sometimes tending to form reticulations.

Description of species (from type): Body greatly elongated, adpressed limbs widely separated; head moderately large, scarcely as wide as body in postaxillary region. Tip of snout rounded; rostral large, distinctly visible above, posteriorly forming an angle; internasals completely free from nasal, subtriangular in shape, in contact mesially; frontonasal much wider than long, laterally in contact with anterior loreal; frontal relatively short (4 x 3.7 mm.), its broad contact with frontonasal nearly a straight line; prefrontals small, widely separated, touching both loreals; a single large fronto-

parietal, wider than long (5 x 3.5 mm.), notched posteriorly by small interparietal; parietals elongate (6 mm.) diagonally placed, not or barely enclosing interparietal; no distinct nuchals; nostril in single nasal, nearly twice as long as high; two loreals, anterior highest; four supraoculars, anterior triangular, second largest, fourth

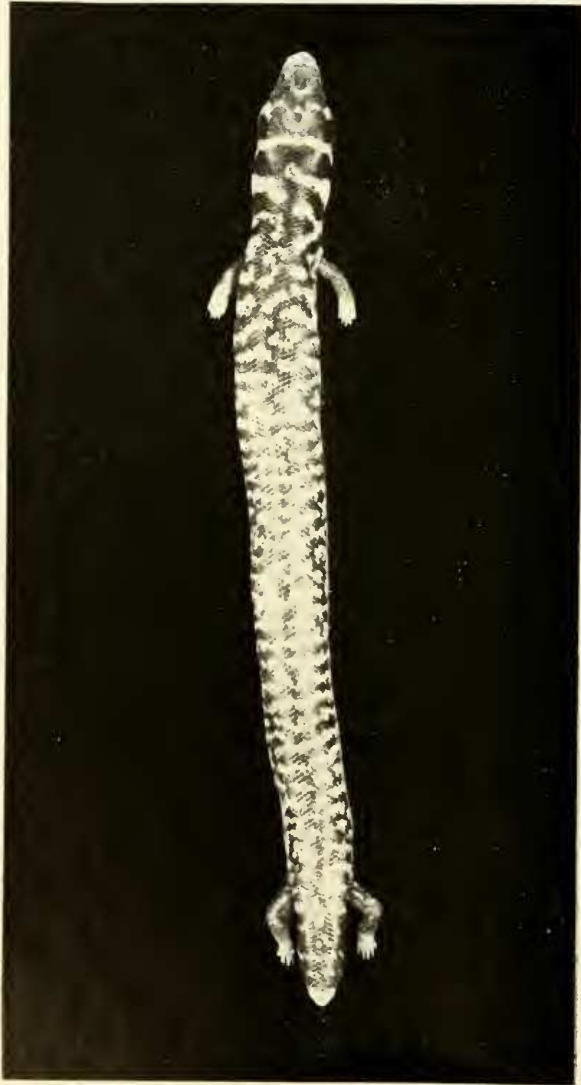


FIG. 72.—*Riopa haroldyoungi* Taylor. Type. From Taylor, Univ. Kansas Sci. Bull., vol. 43, no. 7, 1962, fig. 12. Actual length, 150 mm.

barely touching parietal; six superciliaries, five subocular and pre-ocular scales; upper eyelid greatly reduced, lower lid with at least three rows of small scales.

Nine supralabials, anterior twice as large as any other labial, in contact with anterior loreal behind nasal; three rather enlarged temporals border parietal; mental with a larger labial border than rostral, partially fused to first infralabial; nine or ten infralabials, first largest; an azygos postmental; first chinshield in contact (partly fused), touching labials on one side only; second pair of chinshields separated by two or three scales and also separated from labials by one scale; third pair of chinshields scarcely differentiated.

Ear-opening small, distinct, upper anterior part partially covered by an overhanging scale or scales; limbs short. Arm pentadactyl, clawed, three median digits subequal, their length with claw, measuring about 1.5 mm., twice length of two outer digits; subdigital lamellae five or six; palm with rounded or flattened tubercles; four outer toes longer than inner, strongly curving, with strong well-developed claws; six and seven lamellae under longer toes; tympanum very deeply sunk.

Forty-seven smooth scales in a row about neck; 40-42 scalerows about body at middle; vent bordered anteriorly by ten slightly differentiated scales; basal subcaudals not enlarged or differentiated, greater part of tail missing with regeneration recently begun; 143 scales in a row from parietals to a point above vent.

Color in life: Generally dull black and yellowish ivory; snout-tip rather grayish ultramarine over the thickened scales; head blackish above with slight clouding of ivory-white; two ivory marks on chin run back, then up on side of head to eye; this followed by a similar dark band also proceeding to eye; next ivory band reaches front of parietal; followed by a black band, narrow below, but widening on temporal region; next ivory band encircles head behind parietals; from here on alternating bands are dull blackish and dirty ivory, often broken, sometimes tending to form reticulations; limbs somewhat darker, the light flecks indistinct.

Measurements in mm.: Snout to vent, 136; tail lost (regeneration begun), 14; snout to arm-insertion, 29; axilla to groin, 97; arm, 11; leg, 12; width of head, 12; length of head, 18; snout to ear-opening, 16; snout to arm-insertion in axilla-to-groin distance, 3.35 times; distance between adpressed limbs equals slightly more than 6.5 times length of arm; greatest body width, 13.6.

Remarks: Only the type is known. It was taken at the base of

Doi Suthep Mountain by Mr. Harold Young. It was kept alive at his zoo for some days but in trying to escape it fell in a water tank and was drowned.

The species is named for its discoverer.

Riopa herberti (Smith)

FIG. 73

Lygosoma herberti M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 45, fig. 2, pl. (type-locality, Nakhon Si Thammarat Mts., peninsular Thailand); *ibid.*, p. 55; Bull. Raffles Mus., no. 3, 1930, pp. 35-36.

Riopa herberti: Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 18; M. Smith, Fauna of British India including Ceylon and Burma . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 317 (Isthmus of Kra to Phuket).

Sphenosoma hughi Cochran, Proc. Biol. Soc. Washington, vol. 40, 1927, p. 185 (type-locality, Koh Tao, Gulf of Siam).

Riopa hughi: Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 18, fig. (Ban Hui Ta, Nakhon Si Thammarat).

Diagnosis: Distance between end of snout and insertion of arm, contained 1.75 times in axilla-to-groin distance; 26-30 scalerows around middle of body; 55-56 scales in a line between parietals and a point above vent; dorsal scalerows quinquecarinate.

Description of species (from No. 35692, Ronpibon, Tonka Harbour Tin Mine): Body not especially elongate; head not or slightly distinct from neck; rostral extending onto dorsal surface of snout, separated from frontonasal by supranasals, its posterior border curving rather than angular; frontonasal nearly twice as wide as long; supranasals subtriangular, mesially in contact; frontonasal forming a broad suture with frontal, widely separating small prefrontals; frontal longer than wide (3.8 x 2.5 mm.), anterior suture sinuous, the posterior curving; two frontoparietals each larger than interparietal; latter enclosed by the diagonally placed parietals. No distinct nuchals, scales of first row touching parietals a little larger than scales on neck, the two temporals being largest; nostril in a single nasal, its area greater than the part of the scale preceding or following it; two loreals, anterior higher and narrower than second; four supraoculars the first and second subequal in area, second touching frontoparietal, fourth touching parietal; seven superciliaries; seven well-defined supralabials; first larger than the three scales following but smaller than sixth; six infralabials; mental with a larger labial border than rostral; an azygos postmental; first chinshields touch; second pair separated by a scale, third and fourth scarcely differentiated, widely separated; all chinshields bordering infralabials; 28 smooth scalerows about narrow point of neck; 30 scalerows about middle of body; 57 scales in a row from parietals

to a point above vent; scales in nuchal region smooth; farther back most dorsal scales quinquecarinate. Lateral scales dimly carinate; ventrals smooth. Caudals di- or tricarinate on basal half; 86 sub-caudal scales.

Limbs well developed; adpressed limbs fail to meet by a distance about equal to length of arm; fingers rather elongate, third and

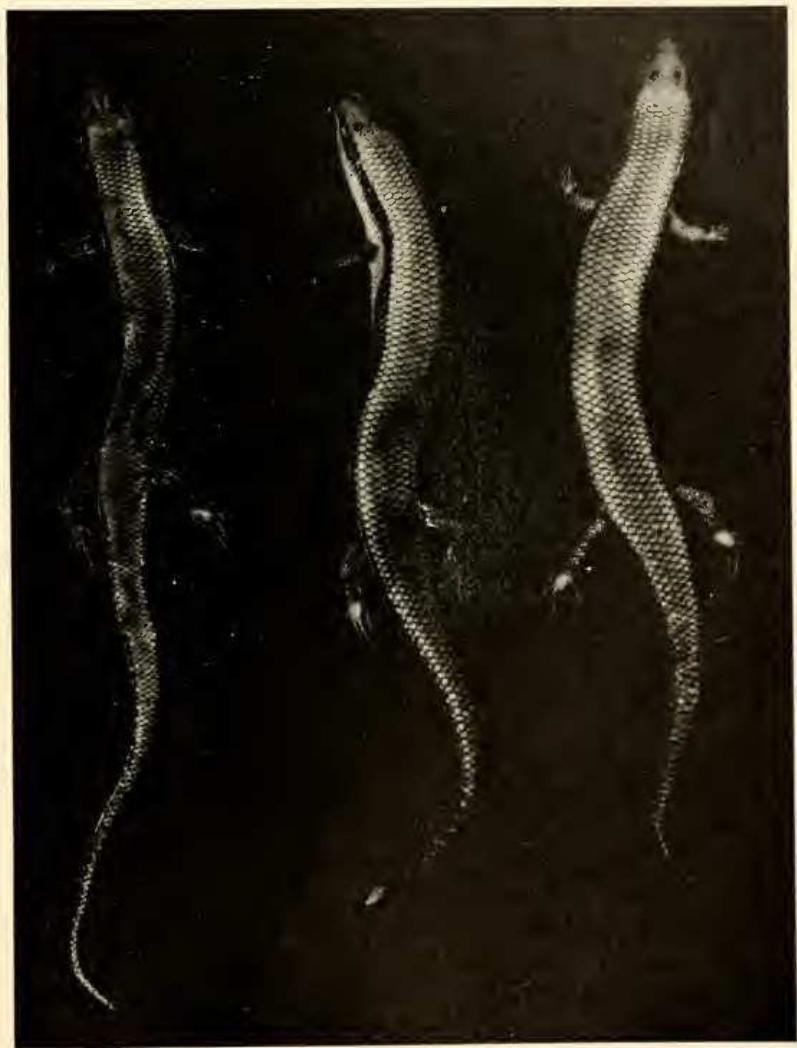


FIG. 73.—*Riopa herberti* (Smith). Left figure No. 35524. Middle figure No. 35692. Right figure No. 35694. Tonka Harbour Tin Dredging Co., Ronpibon, Nakhon Si Thammarat. All approximately natural size.

fourth subequal in length; 12 lamellae under third and fourth fingers, basal ones elevated, rounded, distal ones compressed; palm covered with flattened tubercles; 15 lamellae under fourth toe, the distal ones compressed, the three middle fingers and toes with metacarpals and metatarsals bound together and separated from inner and outer toes.

Color: Dorsal color light tan the scales outlined with darker brown suggesting a continuous reticulum. Side of head darker, especially behind eye and on sides of neck, the color tending to be heavier on scale borders, some of which have lighter centers forming whitish flecks. Remainder of sides slightly darker than dorsum; venter unicolor.

Measurements in mm. of *Riopa herberti*

NUMBER	35472	35524	35692
Snout-vent length.....	66	56	60
Tail length.....	51*	71	52*
Head width.....	9.3	8	9.6
Head length.....	13.4	13	15
Snout to arm.....	20.3	19.2	21
Axilla to groin.....	36.5	31	33
Arm length.....	12	11.3	13
Leg length.....	17	17	17

* Regenerated. Nos. 35472, 35524 are from 5-7 km. west of Nakhon Si Thammarat. No. 35692 from near Rongpibon in the same province.

Variation: There is some variation in the distinctness of the stripe from eye along side of body. In some it is a distinct dark stripe to groin, while in others it can scarcely be distinguished beyond the neck. Usually small whitish flecks are evident on the neck, and sometimes also on the side. One specimen, No. 35694, from near Rongpibon had a bright red tail. There is a slight pattern evident on the venter, the edges of the scales being very slightly darker but this is visible chiefly after preservation.

On the regenerated tail the scales are darker with some transverse marks indicated. Two specimens from Na Bon differ from the Rongpibon specimens in having only six supralabials, the fourth being the subocular. These are darker than most southern specimens.

Distribution: In Thailand the species has been taken in the province of Nakhon Si Thammarat; at Klong Tun Sai in Phuket; at Nam Chik, Pak Chan Estuary, Chumpon.

Remarks: M. Smith has synonymized Dr. Cochran's *Riopa hughi*

from the Island Koh Tao (turtle island) with *herberti*. I have examined the type and concur in the synonymy. My series of *Riopa herberti* show some variation in the characters mentioned by Dr. Cochran as separating the two forms.

M. Smith reports a specimen measuring 67 mm.

Riopa bowringi (Günther)

FIG. 74

Eumeces bowringi Günther, The reptiles of British India, 1864, p. 91 (type-locality, Hong Kong).

Lygosoma bowringi: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 308, pl. 13, fig. 3; Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 320; Flower, Proc. Zool. Soc. London, 1899, p. 650.

Lygosoma comotti Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 4, 1887, p. 622; Fauna of British India, Ceylon, and Burma; Reptilia and Batrachia, 1890, p. 207 (type-locality, Mibha, Burma).

Riopa bowringi: Smith, Fauna of British India including Ceylon and Burma . . . Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 315-316.

Diagnosis: Distance between snout and arm-insertion contained 1.5 times in axilla-to-groin distance; a pair of nuchals present; lower eyelid scaly; usually 28-30 scales around body; tail 1.75 times length of head and body; dorsal scales smooth (rarely dimly keeled); a blackish dorsolateral line.

Description of species (from No. 34325, Bang Saen, Chon Buri province): Rostral moderately large well visible above, its posterior border slightly angular; internasals in contact mesially, touching anterior loreal; frontonasal large, laterally touching first loreal; prefrontals widely separated, the suture between frontal and frontonasal nearly a straight line; length of frontal greater than its distance from tip of snout, less than length of combined parietals and frontoparietals; frontoparietal divided; interparietal enclosed by parietals; one pair of well-developed nuchals; nostril in a single nasal; two loreals, anterior higher and narrower than second; four supraoculars second largest; six supraciliaries; six or seven infralabials; border of mental on lip slightly greater than that of rostral; a large azygos postmental; three pairs of chinshields, first in contact, second pair separated by a scale, third separated by five scales, all pairs bordering infralabials. Two large anterior temporals; scales in 30 rows around neck, 31 rows about middle of body; scales in nuchal region definitely widened, ventral scales larger than laterals but smaller than dorsals; limbs when adpressed fail to touch by a distance equal or slightly greater than length of arm; eleven lamellae under longest fingers; 16 under longest toe; none or a single low projecting lobule from upper anterior border of ear-opening.

Color in life: Above honey-brown with a pair of indefinite dorso-lateral light cream or light tan lines, bordered laterally by a narrow black line running to groin; six median dorsal rows of scales, each scale with a short median bar which together tend to form lines on the back, the two median and the two outer lines being most distinct; a dorsolateral black stripe continued along tail as an in-

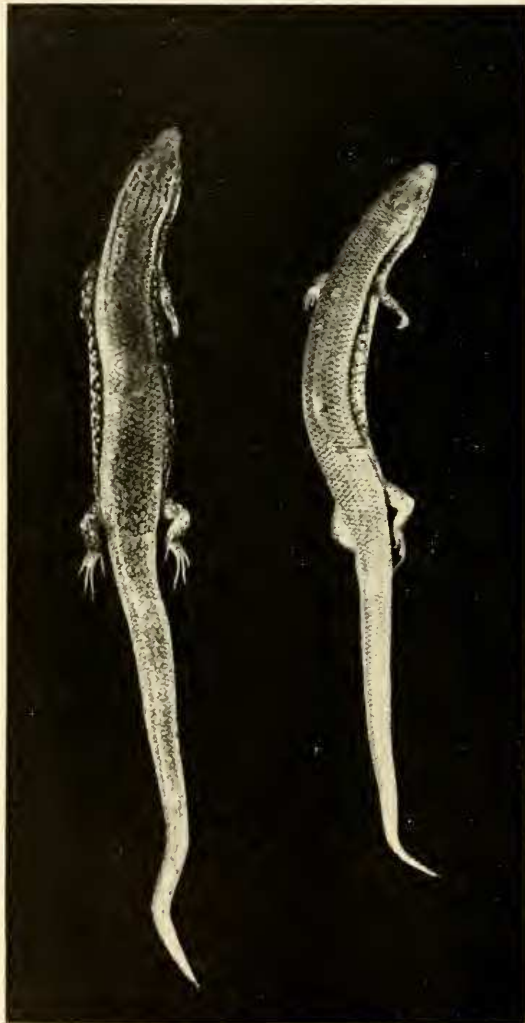


FIG. 74.—*Riopa bowringi* (Günther). Left figure, No. 34325. Ang Hin, Chon Buri province, Thailand. Actual total length, 102.5 mm. Right figure, No. 34281, Bang Saen, Chon Buri province, Thailand. Actual total length, 91 mm.

distinct dotted line; a continuous light line along supralabials with black dots or flecks above and below. Sides of neck and body punctate with black and cream-yellow to ivory-white; chin venter and subcaudal region yellow-ivory.

Measurements in mm.: Snout to vent, 47.5; tail complete, 55; snout to arm-insertion, 17; axilla to groin, 26.5; head width, 7; head length, 11; arm, 8; leg, 13.

Variation: Occasional specimens show slight carination, and I believe this is the condition in the type. A race in the Andaman Islands has tricarinate scales. There are 26-30 scales around the body, and from 52 to 58 from parietals to above vent. There are 10 to 15 lamellae under the fourth toe. A review of the populations throughout the wide range will doubtless show the presence of certain forms that should be distinguished as subspecies.

Distribution: The species occurs widely in Thailand. Specimens have been taken in Chon Buri, Chanthaburi, Loei, Ubon, Udon Thani, Chiang Mai, Prachuap Khiri Khan, Chumphon, Nakhon Si Thammarat, Songkhla, Phatthalung, Pattani, Trang and Yala.

It ranges widely outside of Thailand in Hongkong (the type-locality), Indo-China, Burma, Malaya, Indo-Australian Archipelago as far as Palawan, Philippine Islands.

It is primarily a lowland form but I have taken it at elevations slightly less than 1000 feet. M. Smith reports it at 5,000 ft. in Annam!

Riopa frontoparietalis Taylor

FIG. 75

Riopa frontoparietalis Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 239-242, fig. 11 (type-locality, Hills near Scout Camp, Sara Buri, Sara Buri, Thailand).

Diagnosis: Similar to *Riopa bowringi* except smaller (snout to vent, 41), usually darker brown with frontoparietal single.

Description of the type: Rostral wider than high, visible above; a pair of supranasals forming a short median suture, touching nasals and anterior loreal laterally, about twice as wide as long; prefrontals quadrangular, widely separated, touching both loreals; frontal truncate anteriorly, longer than its distance to tip of snout, shorter than its distance to nuchal; frontoparietal single, much larger than interparietal touching three supraoculars; parietals forming a suture behind the interparietal; a pair of nuchals; nasal seemingly completely divided without separate postnasal; two loreals, anterior the higher, posterior slightly larger and subquad-



FIG. 75.—*Riopa frontoparietalis* Taylor. Type. No. 1694. Boy Scout Camp, near Sari Buri, Sara Buri province, Thailand. Actual total length, 85 mm.

angular; two presuboculars, three postsuboculars connected by a row of tiny scales on lower edge of eyelid; eyelid covered by several scales; two large anterior temporals; three secondary temporals; supralabials, 7-7, fifth below eye; first larger than the three following; seven supraciliaries; mental with an oral border much larger than rostral; one undivided postmental, followed by a large pair of chinshields in contact; a second pair separated by five scales; six infralabials; ear-opening moderate, the anterior border with two lobules; scalerows about neck, 28; about middle of body, 28.

Scales from nuchal to above vent, 56; when arms and legs are adpressed they are separated by five scales; middle finger extends a little farther than fourth, the latter with ten subdigital lamellae; fourth toe longest, with 13 lamellae, tubercular proximally, compressed distally; six preanal scales, two median a little larger than others, and white in color; median subcaudal scales slightly enlarged, 78 in all.

Color in life: Above dark brown, head nearly uniformly colored above; pair of light brown dorsolateral lines, covering part of two or one whole and two half-rows of scales; six median, brown scale-rows each row with a dim dark line. Side with a black line bordering dorsolateral light brown line below which side of neck and body covered with irregular vertical rows of dark brown and cream scales. Central part of supralabials with an indistinct cream line. Chin and ventral surface of body dirty white; underside of tail, gray; median anal scales pure white. Palm, sole, and underside of digits blackish.

Measurements and data of *Riopa frontoparietalis*

NUMBER	1694	33341	33342	33391	33392	33393
Snout to vent.....	38	33	35	41	41	36.2
Tail.....	47	38	41.5	55		42
Head width.....	6.1	6.5	5.4	6.3	6.4	6
Head length.....	9.4	8.5	9	10.4	9.3	9.5
Arm.....	8	6	7	8	8.2	8
Leg.....	10.3	7.5	9.5	12	11.2	11
Scales nuchal to vent	56	59	60	57	59	60
Scales around middle	28	30	30	28	28	30

Genus *TROPIDOPHORUS* Duméril and Bibron

Tropidophorus Duméril and Bibron, *Erpétologie générale* . . . , vol. 5, 1839, p. 556 (type of genus, *cocincinensis*).

Diagnosis: Palatine bones in contact in middle line of palate; pterygoids without teeth or nearly so, touching each other anteriorly;

palatal notch not reaching to level of centers of eyes; teeth conical; nostril in a single nasal; frontonasal single or divided; lower eyelid scaly without disc, tympanum large superficial; no supranasals; prefrontals, frontoparietals and an interparietal present. Limbs normal, pentadactyl with transverse lamellae on under surface of digits. (Frontal may be broken into smaller scales.)

Thailand has five forms here recognized as species. Most species are semiaquatic, being found along streams in hills and mountains. They feed largely on aquatic life. *Tropidophorus thai* may be an exception. This form described by Dr. Malcolm Smith in 1919, was still known from three specimens in 1935. I have found only a single specimen and have one other discovered by Mr. Oliver Gordon Young, and presented to me. These two specimens were taken in the forest foraging at one or two hundred meters from streams or other permanent water. Dr. Smith concluded that the species were all mutually exclusive and no two of them occurred in the same areas. My experience has been different. In Mindanao three species have been taken together, and in Thailand, the forms here recognized as *berdmorei* and *thai* have been taken on Doi Suthep, Chiang Mai in northern Thailand within one hundred meters of one another.

A favorite habitat of the species of *Tropidophorus* is in small streams and rivulets especially where an abundance of small rocks offer shelter and hunting grounds. They dive in the water and search under submerged rocks. They also take to the water to elude pursuit.

Tropidophorus berdmorei one of the species found in this habitat on Doi Suthep, is a handsome species, the smoothness of the scales enhancing the contrast of colors especially when their surface is moist.

The genus has a wide distribution in southern China, Assam, Burma, the Philippines, Celebes, and its range reaches to Queensland, Australia.

KEY TO SPECIES OF TROPIDOPHORUS IN THAILAND

1. Three large preanal shields; lateral scales arranged in strongly oblique rows *microlepis*
- Two large preanal shields 2
2. Head scales smooth; dorsal scales with weak keels in adults 3
- Head scales keeled and rugose; dorsal scales strongly keeled 4
3. Frontonasal single *berdmorei*
- Frontonasal divided *laotus*

4. Frontal divided into symmetrical shields; frontonasal divided; the keels on scales directed upwards and backwards *thai*
 Frontal not divided; frontonasal single; keels of lateral scales point straight backwards *robinsoni*

The genus, quite surprisingly, has not been reported in Malaya. The southernmost point in Thailand at which specimens have been taken is at Tasan, Chumphon. However, I have seen specimens of a species which I strongly believe to be *Tropidophorus*, once at La Doo Tin Mine, Bendang Stah (Benang Star) under a rock at the edge of a small stream; once 16 km. NE of Bhetong in Yala province where one was dislodged from a small bit of drift against a tree growing in a small stream. Both escaped. Chumphon is 375 kilometers north of these points.

Tropidophorus microlepis Günther

FIG. 76

Tropidophorus microlepis Günther, Proc. Zool. Soc. London, Apr. 23, 1861, p. 188 (type-locality, Chartaboom [= Chanthaburi]); The reptiles of British India, 1864, pp. 76-77, pl. 10, fig. A; M. Smith, Proc. Zool. Soc. London, 1923, p. 781 (Dran, Langbian Plateau, S. Annam); The fauna of British India . . . Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 328-329 (Khao Sebab, Chanthaburi).

Tropidophorus cocincinensis: (part.) Boulenger, Catalogue of the lizards in the British Museum (Natural History), vol. 3, 1887, p. 363; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 3, 1919, p. 227.

Diagnosis: Upper head scales rugose or striated; dorsal scales sharply keeled; three enlarged preanal scales; lateral body scales oblique; males with numerous postanal pores.

Description of species (from B. M. No. 1916.6.22.10, ♂. Khao Sebab, Chanthaburi, Thailand): Rostral smooth, thickened considerably, wider than high, forming a curved suture with fronto-nasal; no supranasals; prefrontals forming a suture half the length of the scales, touching two loreals, one supraciliary, and first supraocular laterally; frontal slightly narrower than widest supraocular, longer than its distance to tip of snout, slightly shorter than combined parietals; frontoparietals larger than prefrontals; interparietal narrow, enclosed behind by parietals; nostril in a single nasal; a small postnasal; two loreals, anterior the smaller; a series of small scales between loreals and supralabials; two presuboculars; seven supraciliaries, the series interrupted by fourth supraocular; lower eyelid with two large opaque scales and some much smaller ones; seven supralabials, first smooth, others at least partially rugose or striate; subocular supralabial largest with a diagonal groove; three

to four rows of temporals, all keeled; two large secondary temporals, bordering parietals posteriorly; labial border of mental greater than that of rostral; six infralabials; an azygos postmental, followed by two pairs of chinshields broadly in contact, and a third pair separated from each other by a single scale; scalerows about middle

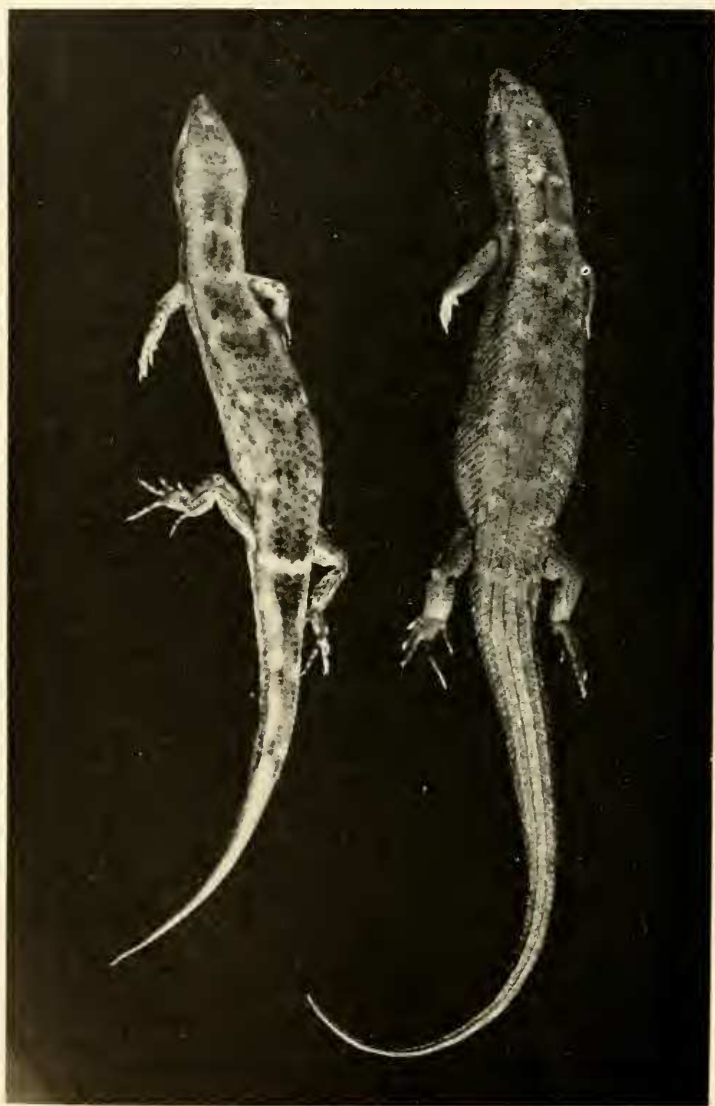


FIG. 76.—*Tropidophorus microlepis* Günther. Left, B. M. No. 1916.6.22.10 ♂. Actual length 150 mm. Right, B. M. 1921.4.1.142, actual total length, 191. Both from Khao Seab, Chanthaburi province.

of body, 31; three enlarged preanals; subcaudals beyond base of tail distinctly widened; ventrals smooth as are scales under chin; scales on throat keeled; terminal half of tail regenerated.

Limbs pentadactyl. when adpressed, longest toe reaches wrist; third and fourth fingers subequal with 13 smooth lamellae below; 20 under fourth (longest) toe. Eye moderate; tympanum superficial, its diameter much less than length of eye; a series of about 19 postanal pores, bordering edge of vent in a continuous series.

Color: Ground color of body light brown with six darker dorsal body blotches, the most distinctive intervening light band on dorsum above vent; anteriorly a suggestion of a dorsolateral line below which are some indefinite black spots or fine diagonal black lines; black indefinite line on latter part of body and base of tail; arms with black flecks; fingers and toes banded with black and amber; a light black-edged indefinite stripe on posterior side of leg.

Measurements in mm. (of B. M. Nos. 1916.6.22.10 and 1921.4.1.-142, respectively): Snout to vent, 76, 83; tail (regenerated), 74, 108; tip of snout to arm-insertion, 28.3, 25; axilla to groin, 38, 43; head width, 12, 12; head length, 20, 19; arm, 20.5, 20; leg, 28, 27.

Variation: The second specimen at hand, differs in being a rusty brown with very indefinite dark blotches above separated by lighter areas or bands, and several scattered small lateral rounded light spots; nine or ten ventral scalerows yellow-ivory, the scales narrowly edged with brown. The supracaudal region is nearly uniform dark brown with indefinite ventrolateral lighter spots. At the base of the subcaudal region there are four paired scales, followed by a median row of 85 widened scales, while the five subterminal scales are paired, the terminal one single.

The specimen is a female and the postanal pores are present, but very much smaller than in the male. The keels of the four median dorsal scalerows on the tail form strong continuous ridges.

The specimen contains several eggs.

Distribution: The present known distribution of this species is in southeastern Thailand, in the immediate vicinity of the type locality, Khao (mountain or hill) Sehab, Chanthaburi, and on the Langbian Plateau in South Annam, from which place Dr. Malcolm Smith collected the species.

Remarks: Dr. Smith kept alive two female specimens from the type-locality. At the end of April they produced seven and nine young, respectively. The lengths of the young at birth were 56 and 60 mm., respectively.

In color they were light brown above with indistinct darker markings; the sides were blackish with small white spots. The venter was whitish, the throat mottled with gray.

Tropidophorus berdmorei (Blyth)

FIG. 77

Aspris berdmorei Blyth, Journ. Asiat. Soc. Bengal, vol. 22, 1853, p. 651 (type-locality, Mergui).

Tropidophorus berdmorei: Theobald, Descriptive catalogue of the reptiles of British India, 1876, p. 48; Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 362; Ann. Mus. Civ. Genova, ser. 2, vol. 5, 1887, p. 480; Fauna of British India, including Ceylon and Burma: Reptilia and Batrachia, 1890, p. 217; Anderson, Anatomical and Zoological Researches and Zoological Results of the Yunnan Expeditions, Reptilia and Amphibia, 1878, p. 796, pl. 76, fig. 3; Rec. Ind. Mus. 1912, vol. 8, p. 59; Smith, Journ. Nat. Hist. Soc. Siam, 1919, vol. 3, p. 225; Proc. Zool. Soc. London, 1923, p. 776; Fauna of British India, including Ceylon and Burma: Reptilia and Amphibia, vol. II, Sauria Feb. 7, 1935, p. 325 (Mergui, central Tennasserim; north Siam, Pegu, Bhamo, and Yunnan).

Tropidophorus yunnanensis Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 362 (type-locality, Hotha Valley, Yunnan); Fauna of British India, including Ceylon and Burma, Reptilia and Batrachia, 1890, p. 217; Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 321; Smith, Journ. Nat. Hist. Soc. Siam, vol. 3, 1919, p. 224.

Diagnosis: No supranasals; scales smooth or posteriorly obtusely keeled; two loreals; six supralabials; two large preanals; prefrontals separated above with dark-edged cream spots; salmon-pink on venter.

Description of species (from No. 33691, Doi Sutep [near Chieng Mai, Thailand], 3000 ft. elevation): Rostral wider than high forming a curving suture with the frontonasal; latter in contact with the frontal thus separating the two small prefrontals; frontal seven-sided, in length, nearly double its distance from tip of snout; frontoparietals two, small; parietals diagonal enclosing small interparietal; four supraoculars the anterior elongate, pointed somewhat, anteriorly touching prefrontal (a small fragment segmented from this scale on each side—abnormal); nostril in a single nasal followed by two loreals; eight supraciliaries, the series interrupted by the fourth supraocular; two presuboculars; six supralabials, first touching first loreal, second both loreals, fourth below eye; a groove from behind nostril crosses fourth labial and terminates at lip; lower eyelid with three or four transparent quadrangular scales separated from supralabials by two or three rows of small granules; two large temporals border parietals; two pairs of nuchals (the second one on left divided); three series of small temporals above last labial; mental large, its labial border nearly double that of rostral; infralabials 5-7, second largest (normally); a large postmental; first chinshields in

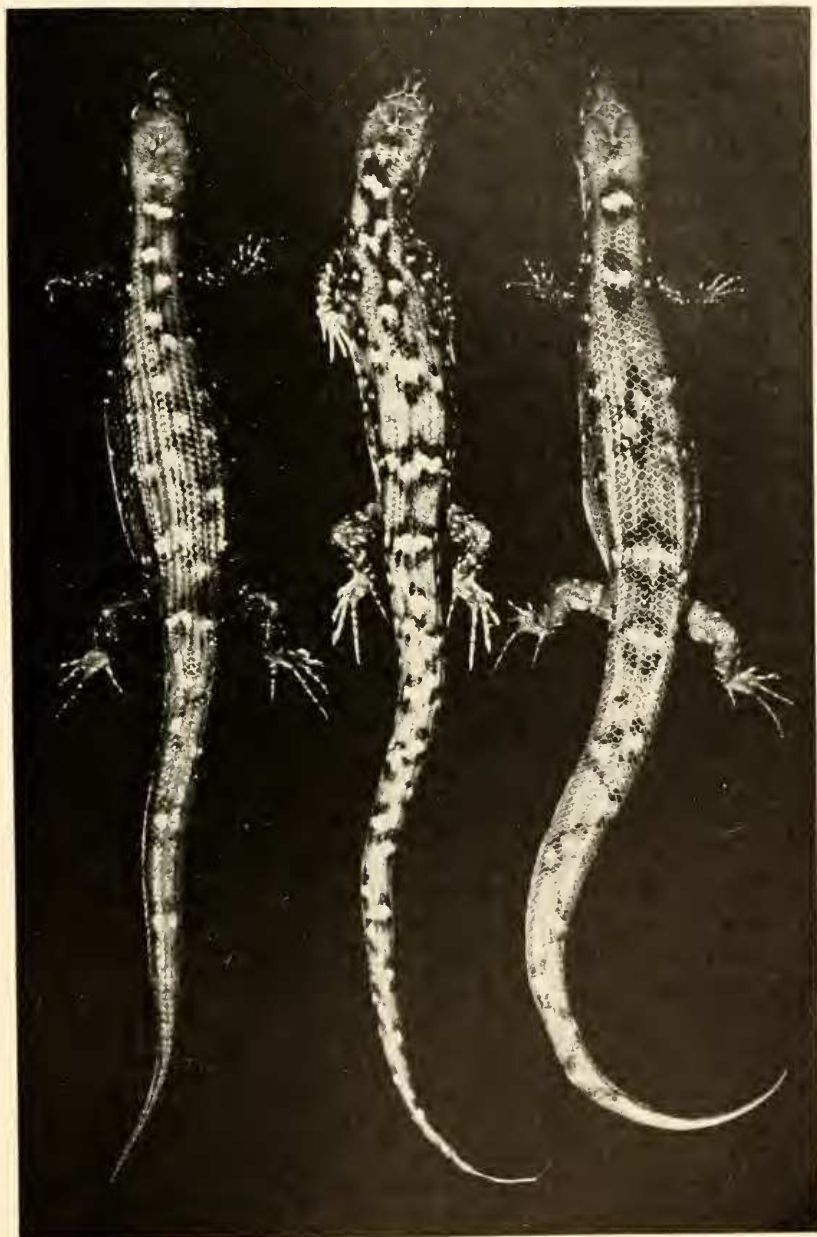


FIG. 77.—*Tropidophorus berdmorei* (Blyth) Left figure No. 35908 ♀. Actual snout-vent length, 82 mm.; tail, regen. 81 mm. Middle figure No. 35960 ♂. Actual snout-vent length, 74 mm., tail complete, 104 mm. Right figure No. 33691 ♂. Actual snout vent, 85 mm., tail 101. All from Doi Suthep, circa 1000 m. Chiang Mai province, Thailand.

contact; second pair separated by a small scale; third pair small separated from labials.

Head scales not keeled or rugose; dorsal lateral and ventral scales smooth except posteriorly and on tail where they are very obtusely keeled; lateral scalerows run straight forward anteriorly, directed somewhat upwards posteriorly; ventrals largest; two much enlarged preanals each flanked by a smaller scale; median subcaudals larger than adjoining scales; 36 scalerows around middle of body; 64 scales from parietals to above vent; 53 from chinshields to vent; tail somewhat compressed (and regenerated on its terminal portion).

Tympanum large, superficial. Limbs short, the adpressed limbs barely touch; digits below with smooth transverse lamellae, 22 under longest toe; scales on forearm and tibia more or less keeled.

Color in life: Above a rich brown, darker on sides; back and tail with irregular lighter cream spots surrounded by a black area or indefinite dark spots without cream areas; sides of body and tail with very numerous blue-white (often dark-edged) flecks scattered or arranged in irregular vertical rows; upper and lower labials, and chin with more or less continuous rows of light dots; throat ivory with considerable dark pigmentation; venter salmon-pink; tail yellow, below blackish flecked with ivory; some salmon-pink on under-side of limbs.

Measurements in mm. of *Tropidophorus berdmorei*

NUMBERS	33691	33695	33693	33689	33687	33688
Snout to vent.....	85	84	84	81	79	68
Tail.....	101*		56*		104	83
Snout to arm.....	28	30	29	30	27	26
Axilla to groin.....	46	43	42	40	42	32
Head width.....	11.5	14	14	11.9	10	9.8
Head to front of tympanum.....	15.5	17	18	17	15	15
Arm.....	19	21	20	19	18	17
Leg.....	27.5	30	30	28	27.2	26
Scalerows at middle..	36	36	36	36	36	36

* Regenerated.

Variation: The series shows only a moderate amount of variation. One specimen, in eleven at hand, has the prefrontals in contact. All the specimens have 36 scalerows around the middle of the body except one, with 38 rows. Females have narrower heads, and a somewhat longer axilla-to-groin distance in proportion to snout-vent length.

The young specimens (smallest 41 mm, snout to vent) have the scales strongly keeled except on venter and subcaudal region; scales on underside of neck are obtusely keeled or smooth.

Seven specimens have the third chinshields touching the labials on one or both sides and this is probably the normal condition to be expected.

Only two have the tails complete or nearly so, the number of subcaudals being 65 and 62. While the loreals vary in shape the first is not divided. One specimen has the second loreal fused with a presubocular; six specimens have a single nuchal, five have two (or the second present on one side).

Most specimens reported from south of Phrae have the prefrontals in contact, while part have a small separate shield separating them. In the specimens from Me Wang none has the prefrontals in contact. There are two anterior loreals in all specimens from south of Phrae.

Remarks: The species is largely aquatic, all my specimens taken were found in a small mountain stream on Doi Suthep either between rocks or under rocks that were partly in the water or with water close to the sandy surface under them. They feed on aquatic life, chiefly water insects, small crustaceans and worms. When disturbed they disappear under the water or into crab holes that are under rocks.

One female contains 12 ovarian eggs about 6 mm. in length. The species is ovoviviparous.

Distribution: Malcolm Smith reports specimens from Khao Pheung and Pan Ton Pheung in hills south of Phrae; Me Wang district as far north as Pa Meang (800-2000 ft. elevation). (These specimens had 32-36 scalerows, 34 being the most frequent number.) The following specimens were reported as *Tropidophorus yunnanensis* (1919) and later placed with *berdmorei*: Doi Nga Chang, southern Me Wang district, 2000 to 3000 ft. elev.; Doi Sutep (Mt.), Chiang Mai at 1500 ft. elev.

Tropidophorus laotus M. Smith

FIG. 78

Tropidophorus laotus M. Smith, Proc. Zool. Soc. London, Dec. 1923, pp. 777-778 (type-locality, Muang Liep, North of Pak Lai, Upper Mekong, French Laos); The fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 325-326.

Diagnosis: Related to *Tropidophorus berdmorei* but differs in having the frontonasal divided, and in having the scales following vent strongly widened; three pairs of nuchals are present, and 36 scalerows.

Description of species (No. 34964 Phu Kading plateau, elevation 3800 ft. Collected by M. R. Pootipong Nupartpat): Head scales smooth with a rather deep groove between frontal and supraoculars; rostral broader than high; frontonasal divided by a longitudinal suture, each much longer than wide; prefrontals in contact broadly; nostril in a single nasal; frontal elongate, narrowed much posteriorly, much longer than its distance to end of snout, slightly longer than its distance to first nuchal; frontoparietal divided (that on right abnormally divided transversely); parietals broadly in contact behind interparietal; three pairs of nuchals; anterior loreal triangular, separated from supralabials; second loreal diagonal, broadly in contact with nasal and second labial; two presuboculars; eight or nine supraciliaries the series interrupted by fourth supraocular; four supraoculars, anterior touching prefrontal, first two touching frontal; two large temporals bordering parietal; other temporals small in three or four rows of three scales each; eyelid with five or six enlarged opaque scales separated from subocular by two or three small scales or scalerows; tympanum nearly as large as eye-opening; six or seven supralabials, fourth below eye bearing a shallow diagonal groove, a continuation of shallow groove between anterior supralabials and other head scales; six infralabials; a mental with a labial border much larger than that of the rostral; an azygos postmental; two large pairs of chinshields first in contact, second separated by a scale, both touching labials; third pair small, separated from labials, and from each other (by 3 scales).

Scales on body in 36 rows at middle directed backwards, ventral scales much larger than dorsals or laterals; laterals distinctly smaller than dorsals; all scales smooth save for a very indefinite suggestion of keels near base of tail; two or three very broad scutes follow vent (postanals); two large preanals; subcaudals widened; (terminal part of tail regenerated); limbs adpressed, the toes reach wrist or a little beyond; scales on underside of thigh and tibia enlarged, subdigital lamellae smooth, rather flat, about 22 under longest toe.

Color in life: Above somewhat olive-brown with a very irregular series of lighter brown marks margined with black; a dorsolateral series of punctate cream spots and numerous lateral punctate cream or greenish white dots on slightly darker sides of body; arms and legs punctate with light and dark flecks. Tail marked in same manner as body. Chin and throat with longitudinal gray and greenish white marks. Venter and underside of limbs pinkish; anal



FIG. 78.—*Tropidophorus laotus* M. Smith. No. 34964, Phu Kading (Mt.) circa 3800 ft., Loei province. Actual total length, 183 mm.

region rose; underside of tail gray growing nearly black under regenerated parts. Head uniform olive-brown above; first five labials with white dots; continuous light lines running under chin.

Measurements in mm.: Snout to vent, 75; regen. tail, 108; total length, 183; snout to ear, 16; snout to arm, 29; axilla to groin, 36; arm, 20.5; leg, 27.8; width of head, 11.3; length of head, 18.4.

Remarks: The species has previously been reported from "Nong Kai on the Mekong" (presumably Nong Khai of Thailand). The specimen at hand was captured on Phu Kading Mt. (plateau) at an elevation of about 3800 ft. by M. L. Pootipong Nupartpat late at night. This is a southern extension of range of approximately 150 kilometers.

The differences of this specimen from the type as shown by the description are not marked. Dr. Smith does not mention specifically the nuchals (shown in figure of *berdmorei*) but one presumes that *laotus* and *berdmorei* are similar in this since he lists the differences between them. The known variation in scalerows is 30-34. He does not describe in detail the postanal scales. There is no small intercalated scale between the prefrontals. However the prefrontal scales are not symmetrical, and are as if a small scale had attached to that on the left side. Likewise it might appear that the anterior loreal had divided and the lower part attached to the posterior loreal.

Tropidophorus thai Smith

FIGS. 79, 80

Tropidophorus thai M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 3, 1919, p. 226; Proc. Zool. Soc. London, 1923, p. 781 (type-locality, Pa Meang, Me Wang district, North Siam); The fauna of British India, including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 328.

Diagnosis: Rostral small followed by a divided frontonasal; prefrontals widely separated by a median azygos scale; this followed by a pair of scales; frontal small, followed by a divided frontoparietal; interparietal separating parietals; two pairs of loreals; two large preanals; four enlarged transverse postanal scales; 34 scale-rows around middle of body, scales keeled, the keels forming longitudinal ridges; lateral scales small, the keels directed upwards and caudad. Head scales rugose.

Description of species (from No. 72, collected at about 3,080 ft. on Doi Suthep, at the Forestry Experiment Station): Rostral wider than high, relatively small; frontonasal divided mesially into two



FIG. 79.—*Tropidophorus thai* M. Smith. No. 36644, 2075 m. Doi Pha Kao Tost, south of Doi Intanon, Chiang Mai province. Actual total length, 88 mm.

longitudinal moieties; a median azygos scale separates prefrontals; this followed by a pair of scales and another small median azygos scale; frontal small; four supraoculars, anterior largest, triangular; a pair of frontoparietals; interparietal narrow, separating parietals; nostril in posterior part of a single nasal; superciliaries, 8-9; lower eyelid opaque, scaly; seven supralabials, fourth below eye; mental with a much larger labial border than rostral; an azygos postmental; first chinshields large, broadly in contact mesially; next pair of chinshields separated by a single small scale, the two pairs touching labials; third chinshields separated by three scales and from labials by one or two scales; six infralabials; tympanum superficial, large, separated from eye by 12 scales.

About 34 scalerows around middle of body; two median dorsal scalerows composed of smallest dorsal scales; four rows lying on side of the median, strongly keeled, keels forming a more or less continuous ridge; scales on sides keeled, small, keels directed upward and backward; six ventral scalerows larger than dorsals, smooth; scales on neck keeled, mucronate; dorsal and lateral caudal scales strongly keeled; 63 smooth, subcaudal, scales; two enlarged preanals; four basal subcaudals about three times as wide as long.

Arms and legs pentadactyl, well developed, when limbs are adpressed along sides toes in contact with fingers; eleven broad flat lamellae under two longest fingers; 17 similar lamellae under fourth toe; palms and soles covered with flat tubercles.

Color in life: Head blackish above and on sides, with a pink spot on frontal area; labials black with small white marks tending to form continuous white lines under chin; scales on chin and throat darker brown with numerous milk-white flakes. Dorsum variegated pink and rusty brown on sides with dim V-shaped marks bordered by slightly darker marks, more evident on tail; ventral scales show light brown edges and salmon centers; sides brownish with a few dim lighter flecks; sides of tail pink and black with some indefinite spots; subcaudal area blackish with irregular markings of yellow.

Measurements in mm. of Nos. 72 and 36644: Snout to vent, 74, 39; tails complete, 79, 49; snout to arm insertion, 26, 15.5; axilla to groin, 38, 18; width of head, 11, 6.7; head length, 15.5, 10; arm, 16, 10; leg, 24, 14.

Variation: So far as I know only five specimens of this species have been taken. These vary as follows: scalerows about body, 34-38; the scales of the region behind the frontonasal usually show two prefrontals separated by an azygos scale. The front part of



FIG. 80—*Tropidophorus thai* M. Smith, No. 72, elev. circa 950 m. Doi Suthep, Chiang Mai province. Actual total length, 153 mm.

the frontal may be broken into two pieces (type) or four or five pieces (paratype No. 3106). The parietals may be separated or form a suture behind the interparietal. The limbs touch or barely fail to meet when adpressed.

A second specimen measured is from the collection of O. Gordon Young. It is dark lavender, the V-shaped light marks are discernible on back and tail. The adpressed leg reaches to the elbow of adpressed arm (legs are normally proportionally longer in young animals than in adults especially old adults).

Distribution: The type locality is Pa Meang, Me Wang, Chiang Mai province, where three specimens were taken. The specimen described here (No. 72) is from an elevation of circa 3,080 ft. on Doi Suthep, Chiang Mai. The specimen was taken about 400 meters from a small stream, foraging under leaves.

The second specimen (EHT-HMS No. 36644), collected by Gordon Young, was found on dry ground under a log, 500 yards from a stream, at 6,800 feet elevation at Doi * Pha Kao Tost, south of Doi Intanon, Chiang Mai.

Tropidophorus robinsoni M. Smith

FIG. 81

Tropidophorus robinsoni M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 3, pt. 3, Aug. 1919, pp. 223-224 (type-locality, Tasan, Chumphon province, peninsular Thailand); Proc. Zool. Soc. London, 1923, p. 778; The fauna of British India, including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, 1935, p. 326; Bull. Raffles Mus., no. 3, Apr. 1930, pp. 29-30, fig. 4.

Diagnosis: Head scales rugose or feebly striate; prefrontals in contact; two loreals anterior not divided; dorsal and lateral scales keeled; a single frontoparietal; frontal not divided; lateral scales directed straight backward; 30-32 scalerows about body.

Description of species (from EHT-HMS No. M.254 Malcolm Smith No. 4216 from Tasan, Prachuap Khiri Khan): Dorsal head scales rugose; head and body relatively slender; rostral wider than high, narrowly visible from above; no supranasals; frontonasal large, single; two large prefrontals in contact; frontal longer than its distance from tip of snout, shorter than its distance from nuchal; a pair of frontoparietals; a long narrow sharply pointed interparietal separating large parietals; latter on left side broken in two; four supraoculars, anterior longest, three touching frontal; seven or eight supraciliaries, series broken by fourth supraocular in contact with edge of eyelid; nostril in a single nasal; two rather large loreals

* Doi = mountain.



FIG. 81.—*Tropidophorus robinsoni* M. Smith. EHT-HMS, No. M 254 (Malcolm Smith No. 4216) Tasan, Prachuap Khiri Khan province, Thailand. Actual total length, 155 mm.

subequal in height; two presuboculars; six supralabials fourth largest, below eye; four rows of small temporal scales, one bordering side of parietal considerably enlarged; two pairs of nuchal scales anterior separated from enlarged temporal by a scale; tympanum large, higher than wide, superficial, its greatest diameter (2.6 mm.) much less than length of eye (4.4 mm.), separated from eye by a distance (5.4 mm.) equal or a little greater than distance between eye and tip of snout; mental large, its labial border nearly double that of rostral; four infralabials; a large azygous postmental, followed by three pairs of chinshields, first pair almost completely in contact, second pair separated by a single scale, but touching; third pair separated by two or three scales.

Dorsal scales keeled, nuchals and one or two following scales with more than a single keel; lateral scales keeled, ventrals show only a trace of keeling; two much-enlarged preanals; dorsal caudal scales keeled at base, lateral rows keeled; more distally lower rows keeled; others smooth; 61 + widened subcaudal scales, extreme tip regenerated; 30 scalerows around body.

Legs rather short, barely meeting or failing to meet when adpressed; 15 smooth lamellae under longest finger, 18 under longest toe.

Color in life: Brownish above with bandlike dark marks most distinct on neck; a series of light spots on dorsolateral line; sides brownish with some darker clouding and a few indistinct light brown flecks or spots; tail indistinctly marked with vertical lighter marks laterally.

Below yellowish white, venter rather uniform, sides of chin and throat speckled with darker; undersides of tail thickly spotted with dark brown, and with darker and lighter flecks.

Measurements in mm.: Snout to vent, 64; tail, 91 +; width of head, 9.3; length of head, 17; snout to arm-insertion, 26; axilla to groin, 37; arm, 14.6; leg, 24.

Variation: The parietals may be completely separated or may form a suture behind the interparietal; the nuchals vary between one and three, one specimen having two on one side, none on the other. The supralabials, at least the first two, may have a small longitudinal ridge or keel; a groove above first two or three supralabials cutting across the fourth labial; scalerows are 30 or 32.

Distribution: Only in the type-locality, Tasan, 25 miles west of Chumphon, is the species known in Thailand.

5. Rostral flat or concave; scalerows round middle of body, 42-44 (rarely 38?); 128 widened subcaudals; rarely a pair of nuchals; 73 scales from parietals to above vent *maculatus*
Rostral not flat or concave 6
6. No dark lateral stripe; dorsum with small somewhat uniform spots arranged in longitudinal and transverse rows; scalerows, 34-36; a small pair of nuchals or none; dorsal scalerows a little wider than laterals, a few scales following nuchals two to three times as wide as long; snout to vent, 90 mm. *tersus*
Not so marked; some or most dorsal scales wider than laterals 7
7. Dorsolateral line broken into a series of dark brown spots, each of which may have two prongs on lower sides, and separated from each other by fawn or buff spots; lips and sides of neck spotted brown; scalerows, 34 (35); subcaudals widened; two median scalerows widened somewhat; 74 transverse rows between parietal and point above vent *scotophilus*
Dorsolateral line normally continuous; large species 8
8. Lateral dark stripe variously flecked and spotted with white; some irregular rows of dark spots on dorsum; scalerows, 38; no nuchals; subcaudals widened; 76 transverse rows from parietals to above vent; snout to vent, 84 mm.; $106 \pm$ subcaudals *lineopunctulatus*
Lateral stripe black without white flecks or spots; deep black in young often faded and dim (rarely obsolete) in the old; 133 widened subcaudals; a pair of nuchals; scalerows, 34-36; 73 transverse scalerows from parietals to above vent; 97 mm. *indicus indicus*

Sphenomorphus mimicus Taylor

FIG. 82

Sphenomorphus mimicus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 234-236, fig. 9 (type-locality, Dong Paya Fai Mts., N. Siam).

Diagnosis: Small skink, 36 mm. snout to vent; total length 94 mm., prefrontals in contact; no supranasals; three supraoculars touch frontal; no postnasal; two frontoparietals; parietals enclose interparietal; one pair of nuchals; seven supralabials, fifth and sixth enlarged; six infralabials, first small; one pair large preanals. Thirty scalerows about body at middle; ventral scales larger than dorsals; subcaudal scales enlarged. Lower eyelid scaly.

Description of species (from type): Very small skink; rostral about twice as wide as high, forming a curved suture with the frontonasal; latter much wider than long, touching nasal and first loreal laterally; no supranasals; prefrontals forming a broad median suture; frontal longer than its distance from tip of snout, shorter than its distance to nuchals, the sides straight, much narrowed posteriorly; two frontoparietals, larger than interparietal; latter enclosed by large parietals; pair of nuchals (a small scale broken from that on left side); nostril in single nasal; no postnasal;

two loreals second one only little larger and equally as high as first; two superimposed preoculars, lower larger; three small pre-suboculars, third notching supralabial series; this followed by three small suboculars, the third of which also notches supralabial series; lower eyelid scaled; four large supraoculars, three touching frontal, fourth followed by a small scale that might be interpreted as a



FIG. 82.—*Sphenomorphus mimicus* Taylor. Type. From Taylor, Univ. Kansas Sci. Bull., vol. 43, no. 7, 1962, fig. 9.

fifth supraocular; fifth and six supralabials larger than others, and somewhat elongated; six infralabials, first about half size of second. Buccal border of mental only slightly larger than that of rostral; large undivided postmental; three well-defined pairs of chinshields; first pair in contact, second pair separated by one scale, third pair

by three scales; scales in 30 rows about body, dorsal scales little larger than laterals but smaller than ventral scales; pair of enlarged preanals; subcaudal scales, after tenth, become enlarged, wider and longer than adjoining scales; approximately 61 scales from parietals to a point above vent; 86 subcaudals from vent to tip of tail; when arm and leg are adpressed digits barely touch; third and fourth fingers of equal length, each with eight or nine lamellae; fourth toe longest with 16 lamellae.

Color: Above variegated fawn with clouding or small indefinite spots of brown; a dorsolateral line from snout, broken, or at times continuous and more or less including some small fawn spots most noticeable along shoulder region; line continued along side of tail but growing very indefinite and finally becoming lost; supralabials and infralabials each with a dark brown spot; sides of head reticulated with brown; side of neck and sides with fine flecks of brown; arms and legs strongly spotted with brown and fawn; chin, venter, underside of limbs, and subcaudal region cream-white.

Measurements in mm.: Snout to vent, 36; tail, 58; total length, 94; snout to arm-insertion, 13.2; axilla to groin, 18.4; arm, 8; leg, 13.1.

Remarks: This species, known only from the type-locality, strongly mimics the small leiopismas in size, color, and form. Nothing is known of the habits of this particular species.

Sphenomorphus grandisonae Taylor

FIG. 83

Sphenomorphus grandisonae Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 236-239, fig. 10 (type-locality "Ban Tong Pheung, M. Siam").

Diagnosis: Small skink; 34 scalerows around body; six supralabials; five infralabials; median suboculars larger than pre- or post-suboculars, the whole series continuous; temporals, $2 + 3 + 4$; no nuchals; dorsal scales smaller than ventrals; subcaudals smaller than lateral caudal scales; dorsolateral markings on side reduced; very slight suggestion of brown dorsolaterally on tail; toes fail to touch when limbs are adpressed; third finger distinctly longer than fourth and all fingers relatively short. Seventy-one scales in a line from parietals to above vent.

Description of species (from type): Rostral visible from above, its posterior border convex, forming a suture with frontonasal; frontonasal wider than long; prefrontals moderate, in contact me-

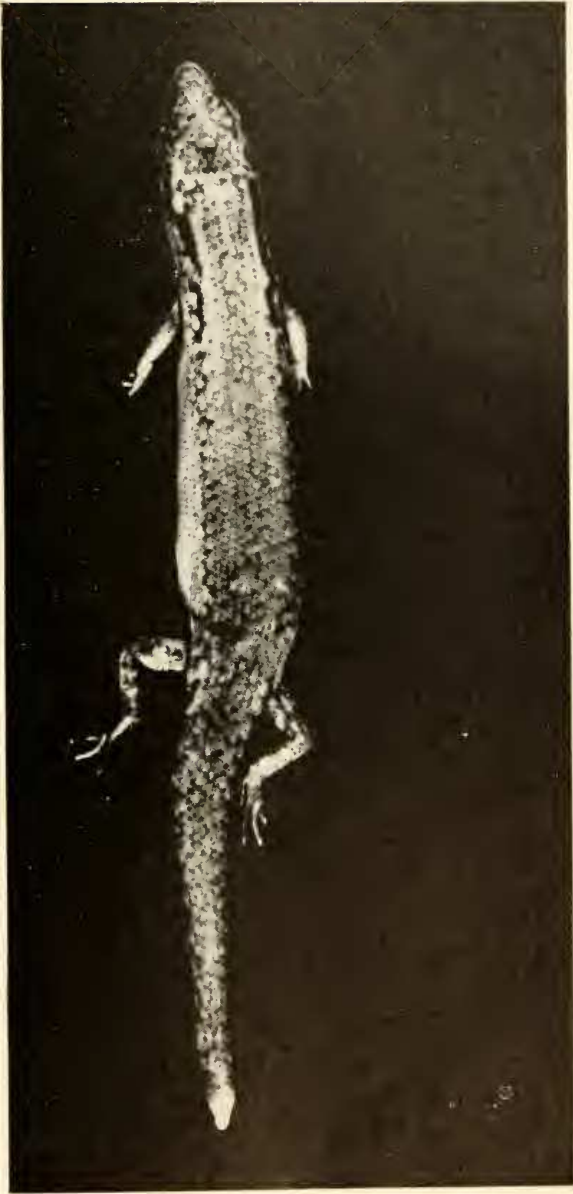


FIG. 83.—*Sphenomorphus grandisoni* Taylor. Type. From Taylor; Univ. Kansas Sci. Bull., vol. 43, no. 7, 1962, fig. 10.

sially, separated from first supraocular; frontal longer than its distance from tip of snout, much shorter than its distance from posterior end of parietal; two frontoparietals, the interparietal enclosed by parietals; no nuchals; nasal diagonally placed, undivided; two loreals, first higher than second; two preoculars; four supraoculars, anterior smallest in area; nine supraciliaries; seven or eight pre-, sub- and postoculars forming a continuous series, none wedged between supralabials; temporals, $2 + 3 + 4$; six supralabials, fourth below middle of eye; five infralabials, first largest; mental with a larger labial border than the rostral; a large postmental; three pairs of chinshields touching labials, first pair in contact, second separated by one scale, third by three scales; lower eyelid scaly; tympanum large, superficial; eight scalerows across neck between darker lines; 34 scalerows about middle of body; 24 scales about tail at 14th subcaudal; median subcaudals definitely not larger than adjoining scales, smaller than lateral caudals.

Arm and leg short, the toes and fingers separated when legs are adpressed; median finger distinctly longer than two adjoining digits, with six lamellae; 12 lamellae under fourth toe.

Color: Above light brown with some minute flecking on dorsal scales but no series of spots; head with supraorbital sutures darkened, as are many other head sutures; lips with dark bars on labial sutures, separated by cream spots; a lighter dorsolateral line on side of neck and shoulder; a brown stripe below light stripe, reaching to shoulder but not continued along side except as very indefinite line of scarcely discernible darker flecking with some lighter dots; dark and light indistinct marks on limbs and tail; on chin, venter, and underside of tail, white or cream; tail broken, regeneration begun.

Measurements in mm.: Snout to vent, 30; tail, broken, 21.5; head, width, 4.1; head, length, 8.2; snout to arm, 12; axilla to groin, 16; arm, 6.5; leg, 9.4.

Distribution: Known only from the type-locality.

Remarks: The scales are slightly elevated giving the impression that they are very bluntly keeled. However, they are not keeled. They are arranged in very straight rows, those on the back being of the same size as those on sides, but smaller than most of the ventral scales.

The failure of any of the subocular scales to form a notch between two supralabials and the presence of a large first infralabial equal to second are characters not usually present in *Sphenomorphus*.

Usually the first infralabial is only about half the size of the second.

The species is named for Miss Alice Grandison, Keeper of Reptiles and Amphibians, Department of Zoology, British Museum, who has kindly loaned the specimen for study and description.

Sphenomorphus praesignis (Boulenger)

FIG. 84

Lygosoma praesigne Boulenger, Ann. Mag. Nat. Hist., ser. 7, vol. 6, 1900, p. 191 (type-locality, Larut Hills, 4000 ft., Perak, Malaya); Fasciculi Malayenses, Zoology, vol. 1, 1903, p. 159; Journ. Federated Malay States, vol. 3, 1908, p. 67; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore; Reptilia and Batrachia, 1912, p. 88.

Mabuia praesigne, M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June 1916, p. 55 (Nakhon Si Thammarat); *ibid.*, vol. 2, no. 2, Dec. 1916, p. 156 (Khao Wang Hip, upper camp, Nakhon Si Thammarat); Bull. Raffles Mus., no. 3, 1930, p. 31.

Diagnosis: Scales smooth; no supranasals present; lower eyelid scaly; parietals form suture behind interparietal; three pairs of nuchals; auricular opening nearly as large as eye-opening, without lobules; a pair of enlarged preanals; 20 lamellae under fourth toe.

Description of species (from British Museum No. 1906.2.28.15, Gunong Kledang, 2,646 ft. Perak): Rostral about one-fourth wider than high, scale curving back onto snout forming broad contact with frontonasal, nasal and first supralabials; frontonasal a fourth wider than long, touching nasal and first loreal laterally; a pair of prefrontals forming a substantial median suture, in contact with two loreals, first supraciliary, and first supraocular; frontal elongate, a little less than twice as long (7 mm.), as wide (3.7 mm.), the scale very narrow through much of its length; frontoparietals moderately large, forming a median suture, much larger than interparietal which is enclosed by parietals; three pairs of nuchal shields.

Nostril in a single nasal followed by a narrow loreal that is slightly higher than larger one following; two preoculars, lower followed by single differentiated presubocular; four supraoculars, anterior longest, three touching frontal; nine supraciliaries bordering palpebrals; lower eyelid scaly, two median scales somewhat enlarged; three or four small postsuboculars; anterior temporal moderate, separated from parietal by a small (temporal) scale; two large secondary temporals bordered posteriorly by four tertiary temporals, uppermost lying chiefly behind parietal; seven supralabials, fifth being subocular and perhaps largest of series; seven infralabials; mental border on mouth considerably wider than rostral border; an undivided postmental; first chinshields form median suture, second pair separated by a single scale, third pair



FIG. 84.—*Sphenomorphus praesignis* Boulenger. B. M. No. 1096.2.28.15, Gunong Kledang, 800 m. Perak. Actual length, 244 mm.

by three scales; fourth pair small, but like other three pairs in contact with labials, and separated from each other by eight scales.

Auricular opening three millimeters in vertical diameter; tympanum deeply sunk. Snout a little longer than eye.

Scales smooth, two median rows distinctly widened throughout body; approximately 64 from parietal to above vent; 32 scalerows about neck; 28 rows about middle of body; pair of enlarged preanals; median subcaudal scales a little larger than adjoining rows.

Arm moderate, adpressed leg reaching to elbow of adpressed arm; 15 smooth rounding lamellae under longest (fourth) finger; 20 lamellae under fourth toe; latter third of tail regenerated, representing two separate growths on regenerated part.

Color: Above variegated buff-brown to deep brown, with indication of about 16 transverse bands of buff-brown with groups of dark blackish brown dots at sides, and separated by slightly lighter bands, which may have a few whitish scales low on sides; unregenerated part of tail with rather well-defined bands of dark or blackish brown interrupted on ventral surface of tail, separated by narrow bands buff-brown above, grayish on sides; some blackish-brown spots in loreal area. Supralabials with median cream spots separated by dark brown spots on sutures; infralabials similar; less distinct spotting on chinshields; throat, venter, and base of tail immaculate cream to yellow; regenerated part of tail brownish with variegated flecks; scales on arms and legs each with a dark brown fleck or spot; some cream flecks on upper side of leg.

Measurements in mm.: Snout to vent, 109; tail, 135; width of head, 19; length of head, 26; snout-tip to arm-insertion, 41; axilla to groin, 52; arm, 32; leg, 42.

Variation: The type shows some differences from this specimen but agrees in essential points.

Boulenger counts a small scale lying back of the fourth supraocular as a fifth "supraocular." The ear-opening is oval, nearly as large as the eye-opening. There are 28 scalerows, the scales of the two middle rows being twice as broad as long. It is described as "Reddish brown above, with scattered black dots, grey on sides spotted with black and white; a series of large roundish black spots on each side of the neck on anterior part of body; lips spotted with black; tail black above and on the sides with irregular annuli of whitish scales; lower parts white." The total length (in mm.), 240; snout to vent, 110; tail, reproduced, 130; head width, 17; head length, 25; arm, 34; leg, 47.

Distribution: To the best of my knowledge the species is known in Thailand only by specimens obtained at Khao Wang Hip, Nakhon Si Thammarat by Malcolm Smith's collector.

The type locality is in the Larut Hills, Perak, a Malay state bordering Thailand on the south. It is a very rare species in Malaya.

Remarks: Three specimens, two adults and one young one, were collected in Thailand. Smith states that all of his specimens had a small extra shield interposed between the frontals and frontoparietals; the specimen I describe here does not have this anomaly. He states that the parietals are not in contact in one of his specimens. (Smith, Dec. 1916, p. 156.)

Sphenomorphus stellatus (Boulenger)

Lygosoma stellatum Boulenger, Ann. Mag. Nat. Hist., ser. 7, vol. 6, 1900, p. 192 (type-locality, Perak, Malaya); A vertebrate fauna of the Malay Peninsula . . . , Reptilia and Batrachia, 1912, p. 87; M. Smith, Proc. Zool. Soc. London, 1921, p. 431; The fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 284-285.

Lygosoma annamiticum Boettger, Senckenbergiana, 1901, p. 47 (type-locality, Phuc-Son, North Annam).

Diagnosis: A species having well-developed limbs; when adpressed leg reaches wrist or elbow; median dorsal scalerows wider than adjoining scales, laterals smallest; two or three pairs of nuchals; 22-24 scalerows around middle of body; a pair of much-enlarged preanal plates; a median and two lateral series of black spots more or less contiguous, interspersed with small starlike light spots.

Description of species (from No. 35439 ♂, Khao Sebah, near Chanthaburi, Chanthaburi province): Rostral moderately large, convex, forming a straight suture with frontonasals; no supranasals; frontonasal wider than long, touching first loreal laterally; prefrontals moderately large separated from each other by a small fragmented portion of posterior margin of frontonasal which prevents contact of latter with frontal; latter much longer than its distance from tip of snout, about as long as combined length of parietals; nuchals, 2-3; nostril in a single nasal; two loreals, anterior a little higher than long; second longer than high; eight supraciliaries; four supraoculars, subequal in size; three temporals, upper secondary very large; seven supralabials; seven or eight small infralabials; mental with a much larger labial border than rostral; a large azygos postmental; three pairs of large chinshields touching infralabials, first in contact, second separated by a scale, third separated by three

scales; a pair of enlarged preanals. Twenty-four scales around neck in a transverse row; 22 scalerows around middle of body; two median dorsal rows widest; those adjoining these also widened; all scales smooth; a few rows of scales preceding preanals are largest ventral scales; subcaudal scales, 62, those immediately following vent transversely widened and largest; terminal part of tail regenerated, scales much widened on regenerated part. Arm and leg well developed, leg reaching wrist of adpressed arm; thirteen scales under longest finger; 18 under longest toe, flattened somewhat at base, compressed distally; ear-opening large, slightly smaller than eye; tympanum superficial; no lobules.

Color in life: Greenish to bronze brown, tail lighter than body; four or five scattered black spots on frontal and preceding scales; one each on supraoculars; a large black spot on fronto-, and interparietals, extending on to parietals; irregular black line of spots, many with fine white dots, from parietals to level of leg-insertion, and continued on tail as a series of small black dots; black spots on supralabials, and a series just below infralabials; black irregular line begins behind eye, extends to groin, and continues on sides of tail as a series of dark vertical bars marking segments, and more or less continuous with a series of subcaudal transverse bars on sides; this black stripe usually with two series of small whitish spots (one directly above other tending to break stripe into a series of spots). In this specimen white markings inconspicuous. Venter greenish white, becoming dark in fixative.

Measurements in mm.: Snout to vent, 57; tail, distal portion regenerated, 59; width of head, 8.5; length of head, 12; snout to arm, 22; axilla to groin, 33; arm, 16; leg, 20.

Variation: There are certain differences indicated between this specimen and the one described by M. Smith (1935). There are two less scales around the middle of body and there are four or five fewer lamellae under the fourth toe.

Distribution: The species has been taken in Thailand at Khao Sebab, Chanthaburi. This is the first and only record for this country. Originally described from the Larut Hills in Perak, it has since been found in southern Annam on the Langbian Plateau.

Remarks: The species was taken by me on the summit of Khao Sebab from underneath dead bark on a standing tree. Another specimen was seen at the same place but it escaped.

Sphenomorphus maculatus (Blyth)

Fig. 85

Lissonota maculata Blyth, Journ. Asiat. Soc. Bengal, vol. 22, 1853, p. 653 (type-locality, Assam).

Hinulia maculata: Theobald, Catalogue of Reptiles in the Museum of the Asiatic Society; Journ. Asiat. Soc. Bengal (extra number) 1868, p. 25; Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, 1870, p. 174; *ibid.*, vol. 41, 1872, p. 123.

Lygosoma maculatum: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 242; The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, p. 196; Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 319; Anderson, Journ. Linn. Soc., vol. 21, 1889, pp. 334, 344; Boettger, Katalog Reptiles Senckb. Frankfurt, 1893, p. 103; Flower, Proc. Zool. Soc. London, 1899, p. 548; Annandale, Journ. and Proc. Asiat. Soc. Bengal, ser. 2, vol. 1, 1905, p. 144; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, p. 154; Hora, Rec. Ind. Mus., vol. 29, 1927, p. 4; Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, pp. 285-286.

Sphenomorphus maculatus: Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, p. 1958, pp. 1116-1118, fig. 17 (Nakhon Phanom province).

Lygosoma mitanense Annandale, Journ. and Proc. Asiat. Soc. Bengal, ser. 2, vol. 1, 1905, p. 144 (type-locality Meetan, S. Burma).

Diagnosis: A small skink (62 mm.); snout short, obtuse, the rostral flattened or concave on dorsal surface, touching frontonasal; prefrontals separated; parietals enclose interparietal; no nuchals; ear-opening about size of eye; a pair of large preanals; limbs well developed, pentadactyl.

Description of species (from No. 33781 Chiang Mai, Thailand): Rostral large broadly visible above, flattened (often depressed) forming a broad suture with frontonasal; no supranasals; prefrontals somewhat quadrangular, separated, touching two loreals laterally; frontal less than twice as long as wide, equally as long as combined parietals; a pair of nuchals; frontoparietals larger than interparietal; parietals in contact behind interparietal; nostril in a large nasal; two loreals, anterior highest; five supraoculars, three touching frontal; eleven supraciliaries; seven supralabials; five pre- and suboculars, the series interrupted; eyelid with three or four transparent scales; temporals, 3-3; mental with a longer labial border than rostral; seven infralabials; a large postmental touching two infralabials; first chinshields in contact; second pair separated by one scale; third pair small in contact with labials; ear-opening vertically oval, much smaller than eye, without trace of auricular lobules.

Scales on dorsum larger than on sides, all scales smooth, in 44 rows; 73 scales from parietals to above vent; 78 scales from chinshields to vent; 124 widened subcaudals; neck scales transversely widened; two enlarged preanal scales flanked on side by two other smaller scales.

Limbs pentadactyl, well developed, the legs reaching beyond axilla; palm of hand covered with rather large (about 20) tubercular scales; sole with two outer metatarsals covered with a few large tubercular scales, the three inner by numerous strongly imbricating smooth scales; fourth toe with 21 compressed lamellae.

Color in life: Above brownish olive or bronzy, growing lighter on tail; top of head with dark areas above orbits and on parietals; rostral light; two series of small black dots on two median scalerows,



FIG. 85.—*Sphenomorphus maculatus* (Blyth).
No. 168, Coffee Camp, Na Bon, Nakhon Si
Thammarat, Thailand. About natural size.

continued as a single series on tail and with occasional flecks of golden green. A narrow blackish-brown line from snout to eye passing above ear to groin, widening on side so as to cover four scalerows and to some extent adjoining rows, borders of stripe not discrete, with a series of somewhat rounded spots; a whitish line beginning behind eye and passing through ear borders; a blackish stripe below; this followed by a scalerow with a few dark flecks; arms and legs flecked or reticulated with blackish olive; underside of chin, venter, and tail immaculate yellowish flesh. Sides of tail with a dim olive stripe and an indefinite series of lighter dots above it. Some blackish flecks on labials.

Measurements of *Sphenomorphus maculatus*

NUMBER	33781	33784	33788	33787	34012
Snout to vent	47	50	50	53	48
Tail	94	95	95	90	94
Snout to arm	16	19	19	15 5	19
Axilla to groin	22	24	24	23	22.3
Head width	7 5	8	8	8	8
Head length	12	12	12.2	12	12
Arm	15	14	15.2	15	16
Leg	24	23.5	24	23	26

Variation: A dark spot immediately above the arm-insertion is usually present. One specimen has the dorsal coloration very light brown with the brown stripe on side formed by five narrow, more or less continuous lines, the light spots confined to neck and shoulder region; the light line below is continuous, while low on flanks there is only a faint pigmentation. The specimen is a female. In one specimen the white line is all but obliterated, the white dots on the stripe more numerous and smaller.

The number of scalerows around the body varies between 42 and 44 (Smith reports 38-42 variation in its range). The two enlarged scales behind parietals are often broken in which case there are no nuchals and this is the more common condition.

Distribution: The species occurs in Northern India, Assam Yunnan, Burma, Cambodia, and in Thailand as far south as the Isthmus of Kra. It is known in Thailand from the provinces of Sakon Nakhon, Nakhon Phanom, Chanthaburi, Nakhon Nayok, Chiang Mai (Doi Suthep), Kanchanaburi, Chumphon, Trad, and Nakhon Si Thammarat. It has also been taken on the islands of Koh Kut,

Koh Chang, and Koh Mak in the Gulf of Siam. The measured specimens are from Chiang Mai.

Sphenomorphus tersus (M. Smith)

FIG. 86

Lygosoma tersum M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June, 1916, p. 44, pl., fig. 1 (type-locality, Khao Wang Hiep, altitude circa 1000 ft., Nakhon Si Thammarat); Bull. Raffles Mus., no. 3, Apr. 1930, p. 34 (Tasan, Pak Chan Estuary, Isthmus of Kra, Chumphon province); The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, p. 284 (Tasan, Chumphon).

Diagnosis: Limbs well developed, pentadactyl; ear-opening distinct; lower eyelid scaly; no supranasals; adpressed limbs overlap; leg does not reach axilla; four supraoculars; 34 to 36 scalerows round body at middle; no lateral dark band; back with small spots arranged in longitudinal and transverse rows, sometimes rather indistinct.

Description of species (from EHT-HMS No. M.251, M. Smith No. 4427 Tasan): Rostral large, the part visible above convex, more than half width of frontonasal, and broadly in contact with it; no supranasals; frontonasal broader than long, touching nasal and loreal laterally; prefrontals rather large, barely touching; frontal elongate, its length nearly double its distance from tip of snout, minutely less than its distance to nuchal; four supraoculars, first largest, two touching frontal; frontoparietals much larger than interparietal; parietals much wider than long, forming a median suture behind interparietal; a pair of small nuchals, the scales following widened, several two to three times as wide (transversely) as long; nostril diagonally placed in rectangular nasal; first loreal rectangular, followed by two larger loreals; two presuboculars; seven supraciliaries, fifth and sixth extremely narrow, in direct contact with palpebral scales; seven supralabials, sixth largest, fifth and sixth below eye; two anterior temporals, two secondaries, upper largest; three tertiary temporals, vertically elongate; lower eyelid covered with several opaque scales; diameter of ear-opening, (2.5 mm.) one half of the length of eye-opening (4.95 mm.); labial border of mental greater than that of rostral; an undivided post-mental followed by a pair of large chinshields broadly in contact; second pair following separated by a single scale; third pair separated by four scales, all touching infralabials; seven infralabials.

Scales smooth in 36 rows about middle of body, dorsal scales a little the larger; two median preanal scales much enlarged, scales



FIG. 86.—*Sphenomorphus tersus* M. Smith, EHT-HMS No. 3899, Forest Experiment Station, Khao Chong, Trang province, Thailand. Approximately natural size.

lateral to them much smaller; eight scalerows behind vent, subcaudal scales become widened (tail reproduced and part missing); when limbs are adpressed toes reach to wrist or a little beyond; about 22 flat scales on palm; fingers with flat smooth lamellae, eleven under two longest fingers; lamellae under toes similar to those on fingers, 18 or 19 under longest toe.

Color in preservative: Rather dark brown above, with a black area above each eye; a dark area on parietals; back with numerous transverse bands of dots which begin low on sides but become less distinct or absent posteriorly; these likewise tend to form longitudinal rows; sutures of supralabials marked fore and aft with dark brown to blackish vertical marks.

Measurements in mm.: Snout to vent, 90.5; tail, broken; head width, 12; head length, 20; snout to arm-insertion, 32.5; axilla to groin, 47; arm, 23; leg, 38. The type measures 92 snout to vent; the tail, 170.

Variation: The distance from snout to arm-insertion is contained in the axilla-to-groin distance, 1.45 times, as compared with 1.25 times in the type. The leg reaches forward to a point above wrist, but not to the elbow; the type has 36 scalerows about the middle of the body.

Distribution: The species is known only from Thailand where it has been found in two places: The type-locality, Khao Wang Hip, Nakhon Si Thammarat, and at Tasan, Pak Chan Estuary, Chumphon.

Sphenomorphus scotophilus Boulenger

FIG. 87

Lygosoma scotophilum Boulenger, Journ. Bombay Nat. Hist. Soc., vol. 13, 1900, p. 335 (type-locality, Batu Caves, Selangor, Malaya); A vertebrate fauna of the Malay Peninsula . . . 1912, pp. 88-89; Journ. Federated Malay States Mus., vol. 8, 1920, p. 289 (Sumatra); M. Smith, Bull. Raffles Mus., no. 3, Apr. 1930, p. 34 (Pulau Tioman, Sumatra).

Lygosoma floweri Laidlaw, Proc. Zool. Soc. London, 1901, p. 310 (type-locality, Gunong Inas, Perak).

Diagnosis: Four (five) supracoculars; no supranasals; lower eyelid scaly; limbs well developed; leg reaching between elbow and axilla; when limbs are adpressed; frontal distinctly shorter than combined parietals, not especially narrowed posteriorly; no nuchals; 34 scales about body; subcaudals widened.

Description of species (U.S.N.M. No. 24031, Trang, Thailand): Rostral large, well visible above, forming a rather narrow curved suture with frontonasal; no supranasals; frontonasal much wider

than long, laterally in contact with anterior loreal and nasal; not or barely touching frontal; prefrontals barely touching or not, touching both loreals; frontal in contact with three supraoculars, longer than its distance from tip of snout, distinctly shorter than combined interparietal and frontoparietals; frontoparietals a little longer than



FIG. 87.—*Sphenomorphus scotophilus* Boulenger.
USNM No. 24031, Trang province, Thailand. Actual
snout-vent length, 35 mm.

wide, posterior borders curving; interparietal narrowly enclosed by parietals which are almost separated posteriorly by a small intercalated scale; no nuchal scales; nostril pierced in a rather large diagonal nasal; no postnasal; first loreal slightly higher but not as wide as second; two preoculars, lower larger than either loreal; two presuboculars; lower eyelid scaly; ear large, smaller than eye, tympanum not deeply sunk, no lobules; two small anterior temporals, two large secondaries, and three or four tertiary temporals; eight supralabials, first small, fifth and sixth largest below eye; nine supraciliaries in a row bordering supraoculars; two or three scales between these and palpebrals anteriorly; eight infralabials; labial border of mental equal or slightly greater than labial border of rostral; a large undivided postmental. Three pairs of chinshields, all touching infralabials, first pair in contact, second pair separated by one scale, third separated by three scales. Seventy-four scales in a row between parietals and a point above vent; median pair of scalerows wider than adjoining scales on anterior half of body; 34 (35) scalerows about middle of body; preanal scales rather feebly enlarged; first eight or ten subcaudals not enlarged, subsequent scales of median row transversely enlarged; terminal portion of tail broken and regeneration begun.

Limbs well developed; third and fourth fingers subequal, with 12 or 13 subdigital lamellae; 19 lamellae under fourth toe; limbs adpressed, leg reaches to a point on arm midway between elbow and insertion of arm; six scalerows on nuchal region widened.

Color: Olive to olive-buff; frontal area rather light; supraoculars and parietal scales with spots or dark lines on scale borders; dorsum brownish fawn with a series of rather heavy dark brown dorso-lateral spots which may have two prongs on lower sides, separated by areas of light fawn; legs and arms brownish with fine lighter dots or marks suggesting a reticulum; venter and subcaudal areas light, whitish or yellowish (discolored in preservative), lips and sides of neck spotted brown.

Measurements in mm.: Snout to vent, 35; tail broken; snout tip to arm-insertion, 13.8; axilla to groin, 16; width of head, 6.7; length of head, 11.5; arm, 10; leg, 15.2.

Remarks: I am, at least temporarily, referring this specimen to *Sphenomorphus scotophilus* Boulenger. There are differences of more or less significance. There are four instead of five supraoculars, the frontal is shorter than the combined parietals rather than as long. There are 34 instead of 30-32 scalerows around body; there are 19 rather than 22-23 lamellae under fourth toe.

It will be necessary to compare this specimen with the type of *scotophilus* before the identity of the specimen can be finally confirmed.

Sphenomorphus lineopunctulatus Taylor

FIG. 88

Sphenomorphus lineopunctulatus Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 232-234, fig. 8 (type-locality, Forestry Station, Sanoi River, Ubon province, eastern Thailand).

Diagnosis: Dark olive-brown above with irregular rows of black dots on back; a broad black lateral stripe punctated at intervals with cream dots beginning on shoulder but preceded by one or two separate spots, bordered above by a line of ground color and this in turn by a very narrow (often broken) dotted brownish white line; this stripe bordered below by a broad light line which in turn is bordered below by a dark line from axilla to groin, its lower edge indefinite; no supranasals; frontonasal single; prefrontals separated; no nuchals; eyelid scaly; no postnasal; three pairs of chinshields all touching labials; 38 scalerows around body; ear-opening nearly as large as eye-opening.

Description of species: Rostral large above, not quite reaching level of line between nostrils, forming a broad suture with frontonasal; latter wider than long, broadly in contact with frontal, bearing a semicircular groove around its anterior part (may be accidental or abnormal); prefrontals separated; frontal much longer than its distance from end of snout, slightly longer than combined parietals; frontoparietal divided; interparietal small, enclosed by parietals; nostril in rather large single nasal; two loreals, anterior highest and narrowest; large preocular with smaller scale superimposed; two presuboculars, latter partially wedged between fourth and fifth supralabials; ten supraciliaries, first not touching frontal; four large supraoculars, three touching frontal, first touching prefrontal; lower eyelid scaly; seven supralabials, fifth and sixth below eye; two anterior temporal and two larger secondary temporals; ear-opening nearly as large as eye.

Scales in 38 rows around body; 42 scales around narrowest part of neck; 76 scalerows (transverse) from parietals to above vent; no nuchals; scales on six median dorsal rows transversely widened, especially so on neck; five paired subcaudals basally followed by a series of 106 single scales (15 regenerated). A pair of enlarged preanals; when limbs are adpressed, toes reach to near elbow, 22 bluntly keeled lamellae under fourth toe; in profile, lamellae forming a strongly serrate row.



FIG. 88.—*Sphenomorphus lineopunctulatus* Taylor. Type.
From Taylor, Univ. Kansas Sci. Bull., vol. 43, no. 7, 1962, fig. 8.
Actual length, 211 mm.

Color in life: Above generally dark olive-brown with head a little darker than body; small black spots on posterior edge of frontonasal, frontal, frontoparietals, and interparietal, and two spots on posterior edges of supraoculars; black marks on supralabial sutures and on temporals; light marks on loreals; one or two black spots on shoulder in front of and above arm-insertion; a black stripe on side, two and a half to three scales wide continued less distinctly on tail, and bearing series of blue-white punctations; narrow whitish dorsolateral line more or less black-edged above, reaching a point above tympanum; dorsum olive with three indistinct rows of black flecks reduced to single median row of larger spots on base of tail; light grayish-white stripe from above arm to groin, but continued on base of tail as a dim dark-gray stripe; leg and to lesser extent, arm, with darker reticulation enclosing lighter flecks; sides of neck plumbeous gray; chin, throat, and breast dirty-white with occasional flecks of blackish; venter and subcaudal region white.

Measurements in mm.: Snout to vent, 84; tail, 127; snout to eye, 6.7; snout to ear, 15; head length, 19.8; head width, 13; snout to arm-insertion, 27.5; axilla to groin, 45; arm, 22; leg, 34.5.

Remarks: It is not impossible that this species is related to *Sphenomorphus indicus*, however, the characteristics, and especially the color pattern, is such that it must be regarded as a distinct species rather than as a subspecies of *indicus*.

Sphenomorphus indicus (Gray)

Hinulia indica Gray, Ann. Mag. Nat. Hist., ser. 2, vol. 12, 1853, p. 388 (type-locality, Himalayas).

Certain populations of *indicus* vary sufficiently to be regarded as subspecifically distinct. One of these is *Lygosoma zebratum* Boulenger from Mt. Muleyit, in southern Burma (Tenasserim), placed in the synonymy of *indicus* by M. Smith. If not specifically distinct, it should be recognized as a subspecies of *indicus*. It has not been reported from Thailand but the probability is strong that it occurs in the Bilauk Tuang mountain range in the peninsular part of Thailand.

I have referred the northern Thai population to the typical form.

Sphenomorphus indicus indicus (Gray)

FIG. 89

Hinulia indica Gray, Ann. Mag. Nat. Hist., ser. 2, vol. 12, 1853, p. 389 (type-locality, Sikkim [restricted], Himalayas); Stoliczka, Journ. Asiat. Soc. Bengal, vol. 41, 1872, p. 122, pl. 4, fig. 2.

Eumeces indicus: Anderson, Proc. Zool. Soc. London, 1871, p. 158.

Lygosoma indicum: Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 241, pl. 16, fig. 1; The fauna of British India, including Ceylon and Burma; Reptilia and Batrachia, 1890, p. 195; Ann. Mus. Civ. Genova, ser. 2, vol. 13, 1893, p. 319; Wall, Journ. Bombay Nat. Hist. Soc., vol. 18, 1908, p. 505; M. Smith, Bull. Raffles Mus., no. 3, 1930, p. 33; Journ. Nat. Hist. Soc. Siam, vol. 6, 1923, p. 200 (Hainan); Hora, Rec. Ind. Mus., vol. 29, 1927, p. 4.

Sphenomorphus indicus: Schmidt, Copeia, 1928, p. 80; Pope, Bull. Amer. Mus. Nat. Hist., vol. 58, 1929, p. 380.

Sphenomorphus indicus indicus: Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1113-1116, fig. 16 (Loei).

Lygosoma cacharens Annandale, Journ. Asiat. Soc. Bengal, new ser., vol. 1, 1905, p. 145 (type-locality, Nemotha, Cachar) (*vide* M. Smith).

Lygosoma bouringi: (*non* Günther) Mell, Arch. für Nat. Berlin, vol. 88, 1922, p. 113 (*part. vide* M. Smith).

Lygosoma indicum indicum: Smith, Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. II, Sauria, Feb. 7, 1935, pp. 281-282.

Diagnosis: A large skink (snout to vent, 97 mm.); rostral convex, not depressed above, in contact with frontonasal; prefrontals separated; sole and palm covered with tubercles, brown, with or without some scattered dark spots; dark lateral stripe usually edged with lighter color above. Siam specimens usually with 34-36 scalerows around middle of body; ovoviviparous; limbs well developed, overlapping when adpressed.

Description of species (from No. 33759, Doi Suthep near Chiang Mai, Thailand): Snout short, rostral convex, forming broad suture with frontonasal, which is broader than long; no supranasals; frontal as long as combined parietals, touching three supraoculars; paired frontoparietals little larger than interparietal; parietals inclosing interparietal; pair of nuchals; nostril in single nasal; two loreals, the anterior highest touching two supralabials; posterior also touching two supralabials; three presuboculars, anterior large; nine supraciliaries; four large supraoculars, one large anterior temporal not touching parietal; two large secondary temporals; three tertiary temporals upper bordering parietal; eight supralabials, fifth and sixth below eye; postoculars scarcely differentiated; labial border of mental equal to that of rostral; eight infralabials; large postmental; three pairs of chinshields, first in contact; second pair separated by one scale, third touching labials, small.

Lower eyelid with four or five semitransparent scales and three rows of granules; ear-opening nearly size of eye-opening, vertically oval without lobules on border.

Scales on body smooth, imbricating, subequal, in 34 rows around middle of body; 73 scales in row between parietal and point above vent; 75 scales between first chinshields and preanals; 133 widened

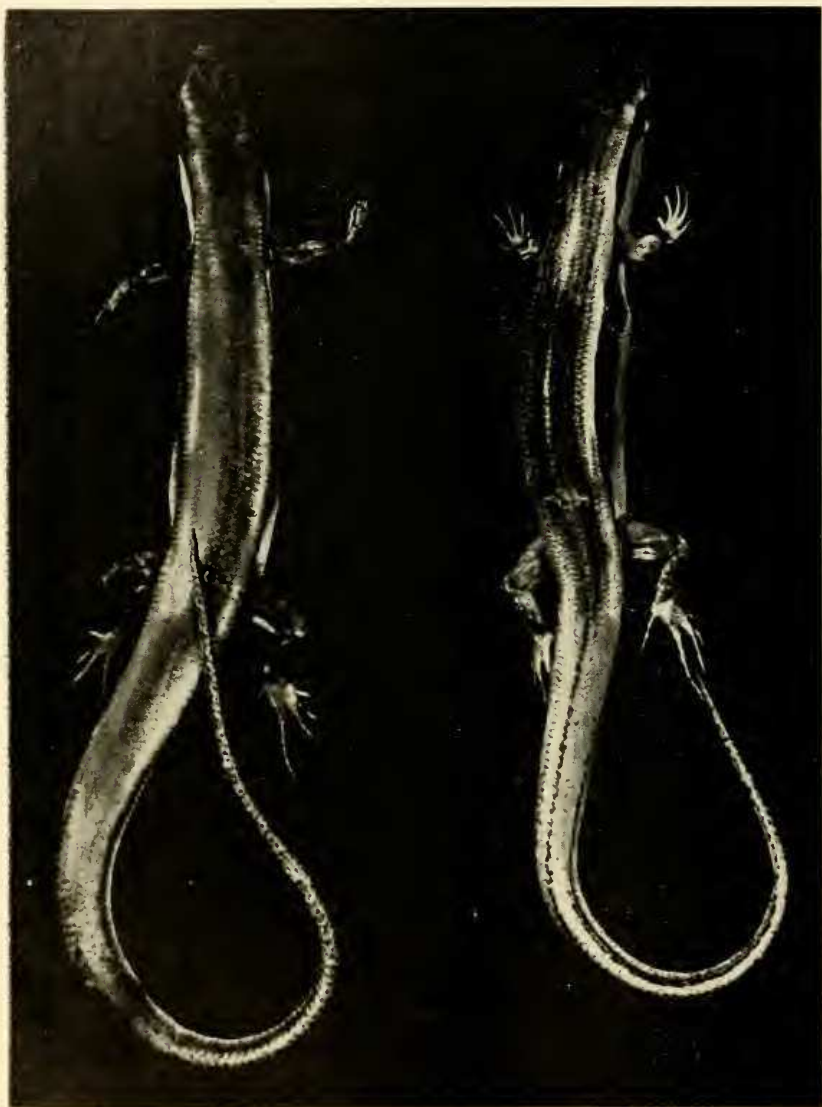


FIG. 89.—*Sphenomorphus indicus indicus* (Gray). Left figure, No. 36128. Actual snout-vent length, 80 mm.; total length 245 mm. Right figure, No. 35913. Actual snout-vent length 74 mm.; total length, 195 mm. Both from circa 1000 m. Doi Suthep, Chiang Mai province, Thailand.

subcaudals; pair of large preanals, each bordered laterally by two scales.

Limbs well developed, leg reaching to halfway between wrist and elbow; palm and sole covered with tubercles, those on hand slightly imbricating; 18-19 lamellae under fourth toe. Scales on back of thigh somewhat elongate but not enlarged.

Color: Head brownish or olive-brown, central area of dorsal scales darker; outer scalerows on dorsum lighter than back, bordering the lateral stripe, beginning on snout widening on sides so as to cover most of four scalerows; lower flanks whitish with little or no pigment; chin, venter, and underside of tail immaculate whitish. Tail lighter than body, with median and two dorsolateral lines composed of black flecks continued to tip.

Black markings on back small to microscopic; labials with dim black lines along sutures especially on supralabials. Arms and legs much lighter (nearly fawn-color) with little dark pigment.

Measurements in mm. of *Sphenomorphus indicus indicus*

NUMBER	33759	33761	33762	33758	33760	33763
Snout to vent.....	81	82	82	92	97	72
Tail.....	148	154	.....	.....	.....	147
Snout to arm.....	27.5	27.8	27	30	29.8	24
Axilla to groin.....	45	43	42	50	53	35
Head width.....	12	12	14	14.5	13.6	11
Head length.....	19	19	19.4	21	21	15.6
Arm.....	23	23	24	24.2	25	20
Leg.....	34	34	35.2	37.2	36	32

Variation: The problem of subspeciation in this species has not been solved. Evidence points to considerable variation in various populations outside of Thailand. Most of my material is from Northern Thailand, the measured series being from Doi Suthep, Chiang Mai.

The young specimens (snout to vent 45 mm.) have scales strongly striated with (usually) broken sinuous striae, 25 to 30 in number. The color of the dorsum is dark, almost blackish brown. The black lateral line is very distinct, its lower edge somewhat uneven or sinuous. On side of head and neck below the black stripe, it is cream-white to greenish white with two series of spots, one on supralabials and one on infralabials. These continue back on side of head and neck to arm-insertion. Bordering the dorsolateral black

stripe below is a fine ivory-white line, often seemingly broken into spots by the irregular black edge.

Specimens 65 to 72 mm. snout to vent, still display the striations on the scales, usually more pronounced on the posterior part of back and on the flanks. The marks on the neck tend to disappear, but the labial marks are still more or less distinct. There is a more or less distinct hair-fine light line bordering the dorsolateral stripe above, while the line below the stripe is now obsolete.

In the oldest (largest) specimens, those with a dark black lateral stripe may show some darkening on the edges of the dorsal scales, and when submerged in clear liquid seven darker lines may be discerned. A few specimens, regardless of sex, lose the dorsolateral stripe, the region showing a slight olive tinge or a light brown color. The labial spots are missing in old adults. A number of specimens have dotted lines on the tail, the median dorsal line being most distinct.

In squamation the differences are not great. The primary temporal is divided in two about 50% of the time, exactly so in 17 adult specimens; sometimes they are the same on both sides of the head; in five cases it is divided on one side but not on the other. The scalerows in this series of 17 are 32 (3 times), 34 (9 times), 36 (five times).

Distribution: In Thailand the species is known from the north-western part of the country. Practically all specimens I have taken or seen are from the mountain of Chiang Mai, Loei and Phrae provinces.

Elsewhere it is known in northern India, Sikkim, Assam and Burma and "all of Indo-China" (*vide* Bourret *), southern and central China, occurring as far north as Nanking in the east, Shensi and Szechwan in the west (*vide* Pope **).

Pope ** suggests that valid subspecies occur in China and several have already been defined by other authors.

Remarks: The young of *indicus* are born alive, six to nine young being produced in the same litter.

The species has been reported from Malaya based on certain specimens taken on Fraser's Hill. They may well represent a new subspecific form, and should be re-examined. They may be more closely related to *zebratus* than to *indicus*.

* Bourret, Notes herpétologique sur l'Indochine Française, Anneu Bull. Gen. Inst. Publ. 4 Dec. 1939, p. 52.

** Pope, The reptiles of China, Nat. Hist. Cent. Asia, vol. 10, 1935, p. 482.

Leiolopisma Duméril and Bibron

Leiolopisma Duméril and Bibron, *Erpétologie générale* . . . , vol. 5, 1839, p. 742 (type *Scincus telfairii*).

Diagnosis: No supranasals; an opaque or transparent disc in lower eyelid; frontoparietal divided or single.

The taxonomy of this group of skinks, a part of the old genus *Lygosoma* (*sensu* Boulenger), has not been very stable. Some ten other genera were proposed before 1879, when Boulenger placed them under *Lygosoma*. While many authors have used this "catch all" others have regarded *Leiolopisma*, with its numerous included generic synonyms, a legitimate genus. Mittleman* has attempted to divide *Leiolopisma* into several genera using as generic characters, reduced size of interparietal, size of ear-opening, length of limbs; digit loss, as well as the more conventional criteria. It is not impossible that a better understanding of the skinks will be obtained by a recognition of some of the genera he has proposed or revised, but in its present form Mittleman's paper is in many ways still unsatisfactory. I believe it is a step in the right direction.

These small skinks are difficult to deal with largely because of their small size. If differences are magnified in relation to the whole animal they often seem, as they should, of greater significance. Another fact is that in the Scincidae differences of specific rank may involve fewer scales and as pointed out by Stejneger, may require one to consider more carefully, the scales in the temporal region. I also suggest that pre- and postsuboculars and their relation to the labial series may serve to distinguish groups of species in the Scincidae.

The number of these small species in Thailand is not certainly known, largely because the number of specimens available from any given locality is small, and the amount of variation is unknown. If one accepts the "law of vagility" which states that "small and burrowing forms of reptiles and amphibians, being least vagile, have a tendency to speciate more than larger, more vagile forms," one might expect to find a fair number of species and subspecies in Thailand. They are timid species that seemingly rarely expose themselves to sight, and this would seem to be a habit that serves them for survival.

I have placed ten nominal forms in the key as species or subspecies. Whether *Leiolopisma reevesii* occurs in Thailand is still open to question. I have compared specimens of Dr. Cochran's

* Smithsonian Misc. Call., vol. 117, no. 17, 1952.

eunice with specimens of *reevesii* from Canton, China (a probable type-locality for *reevesii* in "southern China") and while the Cantonese material has been preserved a much longer time I believe the two are distinct. I suspect that Dr. Malcolm Smith considered *reevesii* a Thai resident because of his opinion that *eunice* and *reevesii* were synonyms. One of the chief distinguishing features between them is size of the subcaudals in *reevesii*.

While I am not completely satisfied with this treatment, because of inadequate materials, the following key is offered as a tentative arrangement of the Thai forms:

KEY TO THAI SPECIES OF *LEIOLOPISMA*

1. Frontoparietal single; prefrontals broadly in contact; no transversely widened nuchals; a lateral dark line bordered by a light dorsolateral line above; eight scalerows between dark lateral stripes; adpressed limbs overlap about length of hand; 30 scalerows at middle of body *pootipongi*
- Frontoparietal divided 2
2. Body with continuous stripes of black and white (green or gold) 3
- Body lacking continuous black and light stripes 4
3. Five light stripes (white, greenish-white, yellowish or golden) with four black stripes; tail orange; 30-32 scales around middle of body; three pairs of nuchals *vittigerum microcerum*
- A median stripe (white, greenish or golden in life) from tip of snout to tip of tail; sides light brown or greenish, speckled with black; 22-26 lamellae under fourth toe; 28-30 scalerows around middle of body *vittigerum vittigerum*
4. Adpressed limbs fail to meet in adults (may touch in very young) ... 5
- Adpressed limbs touch or overlap in adults and young 8
5. Nuchals present 6
- Nuchals absent 7
6. Scales in 34 rows around middle of body; adpressed limbs fail to meet by length of foot; "several pairs of feebly enlarged nuchals"; subcaudals somewhat enlarged; 18 lamellae under fourth toe; light gray to cream-white (yellowish white) below *eunice*
- Scales in 28 rows around middle of body; six scalerows on back; three pairs of nuchals; 18 lamellae under fourth toe; limbs narrowly fail to meet; drab gray on undersurfaces *smithi*
7. Scales in 26 rows about middle of body; 14 lamellae on underside of fourth toe; tail nearly twice length of head and body; anterior loreal longer than high. Limbs fail to meet by length of arm; subcaudals not enlarged *tavesae*
- Scales in 30-32 rows around body at middle; 15-17 lamellae under fourth toe; limbs narrowly fail to touch in adults; subcaudals slightly enlarged; brown dots on throat *kohtaoensis*

8. No dark lateral stripes or lateral series of dark spots; snout to vent, 51 mm.; prefrontals touch at a point; scalerows 34; leg reaches to elbow when limbs are adpressed; 20 lamellae under fourth toe; a median pair of nuchals *siamensis*
- A dark lateral stripe or lateral series of dark spots 9
9. Adpressed limbs overlap slightly in adults; 36-38 (34) scales about middle of body; lower rows of scales with small black dots, forming broken lines encroaching on venter slightly, and on underside of neck; prefrontals form a good suture; no nuchals; larger, snout to vent, 60 mm.; small scattered dorsal spots *melanostictum*
- Adpressed limbs overlap, the leg reaching elbow or beyond; a feebly enlarged pair of nuchals; 30 scalerows about middle of body; snout-to-vent length, 50.5 mm.; a paired series of subquadrangular spots on anterior half of body, united posteriorly *rupicolum*

Leiopisma pootipongi Taylor

Leiopisma pootipongi Taylor, Univ. Kansas Sci. Bull., vol. 40, 1962, pp. 244-246 (type-locality, Forest Station, Sanoi River, Ubon (province), Thailand).

Diagnosis: A small skink (snout to vent about 38 mm.); frontoparietal single; prefrontals broadly in contact; a dorsolateral light line separated from its fellow by six scalerows; a lateral dark stripe bearing some small white dots; limbs overlap the length of hand; 30 scalerows about middle of body; 66 scales in a line from parietal to above vent.

Description of species (from type): Rostral large, much wider than high, forming a broad suture with frontonasal; frontonasal nearly twice as broad as long touching first loreal laterally; prefrontals large, broadly in contact, laterally touching both loreals and first supraocular; frontal narrowed to a blunt point posteriorly, touching two oculars, a little longer than its distance from tip of snout, shorter than combined length of frontoparietals and parietals; four supraoculars, anterior triangular; eight supraciliaries; nasal single; anterior loreal higher and narrower than second; three pre-suboculars, third wedged between edges of fourth and fifth supralabials; three or four postsuboculars, last wedged between fifth and sixth labials; seven supralabials fifth and sixth below eye; two small temporals between sixth labial and the very large temporal bordering parietal, one between seventh labial and same scale.

Lower eyelid with an undivided transparent disc; ear opening relatively large (1.2 x 1 mm.); six infralabials, first very small; mental with a larger labial border than rostral; one large azygos post-

mental; first pair of chinshields in contact; second largest, separated by one scale, third by three scales, fourth by four scales, all chinshields in contact with infralabials. Thirty smooth scalerows around middle of body (slightly farther forward the count is 32); eight scalerows on back subequal, except scales following parietals in median rows are somewhat transversely widened; subcaudal scales near base of tail not noticeably enlarged; farther out median scales distinctly wider than adjoining ones; two preanals large; adpressed limbs overlapping; 18 lamellae under fourth toe; 66 scales in a median row between parietals and a point above vent.

Color: Above brown to olive-brown; the supraocular areas of head dark. A pair of dorsolateral light lines, moderately distinct; on middle of back a row of dark spots paired anteriorly; an indefinite dark streak along dorsum of tail with a wide lighter dorsolateral stripe bordered laterally by an indefinite darker line; a dark lateral stripe beginning behind eye, passing distinctly above ear, very irregular on its lower edge, bearing several small punctate light spots; dark color widens on neck and shoulders, reaching down almost to arm-insertion and here bordered by a light line; lower flanks, chin, venter, underside of limbs and subcaudal region immaculate, all whitish except subcaudal region pinkish; labials cream with sutures bordered by darker blackish-brown pigments; arms and legs brownish enclosing lighter spots.

Measurements in mm. (type): Snout to vent, 37.2 tail broken; snout to ear, 7.6; length of head, 9.4; width of head, 5; snout to arm-insertion, 13.7; axilla to groin, 19; arm, 10; leg, 13.8.

Remarks: This species is known only from the type locality and only from the type. It seems that on the basis of the undivided frontoparietal it is related to the Indian *L. palnicum* but differs in the narrower dorsal scales. In *palnicum* the dorsals are three times as wide as long. The species is named for M. R. Pootipong Nupartat Varavudhi in Chulalongkorn University who accompanied me on numerous journeys into the hinterlands of Thailand.

Leiolopisma vittigerum (Boulenger)

Two subspecies are recognized that may be differentiated by the following key:

A median light stripe, greenish yellow or golden (iridescent), bordered on each side by black stripes; a short dorsolateral dark stripe anteriorly *L. vittigerum vittigerum*
 Five light stripes with four well-defined black stripes, *L. vittigerum microcerum*

Leiopisma vittigerum vittigerum (Boulenger)

Lygosoma vittigerum Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. XIV, 1894, p. 615 (type-locality Sereinu, Mentawai Islands); Journ. Federated Malay States Mus., vol. 3, 1908, p. 67; A vertebrate fauna of the Malay Peninsula from the Isthmus of Kra to Singapore; Reptilia and Batrachia, 1912, p. 94; Smith, Journ. Nat. Hist. Soc. Siam, vol. 1, 1915, p. 154 (Bong Tee Valley, Sai Yoke); *ibid.*, vol. 2, June, 1916, p. 56.

Lygosoma pulchellum: (*non* Boulenger) Annandale, Journ. and Proc. Asiatic Soc. Bengal, new ser., vol. 1, 1905, p. 145.

Leiopisma pranensis Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 18, fig. (type-locality Pran, Siam) lat. 12°, 40' N. (*vide* M. Smith).

Leiopisma vittigerum vittigerum: Smith, Fauna of British India including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 8, fig. 3 (numerous localities).

Diagnosis: A diminutive skink; snout rather pointed; three or four pairs of nuchals; ear-opening smaller than transparent disk on eyelid, without lobules; median pair of dorsal vertebral scales widened; two large preanals; subcaudals widened; prefrontals in contact; median light or golden stripe bordered by black stripes; sides greenish olive, with or without black dots or flecks; ventral surfaces greenish white.

Description of species (from Chanthaburi, B. M. No. 1933.12.1.9): Snout distinctly narrowed, tip rather pointed; rostral large, well-visible above forming a curving suture with frontonasal; latter a little broader than long; *prefrontals very large* broadly in contact; frontal widest at anterior level of supraoculars, much narrowed behind; shorter than its distance from tip of snout, shorter than combined length of parietals and frontoparietals; frontoparietal divided; interparietal biangular a little wider than long enclosed behind by parietals; two pairs of nuchals, first pair longer than second, equally widened transversely; a single nasal; two low, rather elongate loreals; two preoculars; one presubocular; four supraoculars; an elongate primary, two secondary temporals, lower largest, and three tertiary temporals; upper tertiary much enlarged, not widely separated from its fellow. Ten or eleven supraciliaries; eight supralabials, sixth largest, below eye; six or seven infralabials; border of mental on lip larger than that of rostral; an undivided postmental; first pair of chinshields in contact, second pair separated by a scale, third pair separated by three scales.

Scale rows about body 28; four median rows strongly enlarged, two median larger than adjoining rows: 76 + subcaudals (extreme tip of tail missing); leg reaching nearly to elbow when limbs are adpressed; fourth finger longer than third, with 23 lamellae, those on basal two thirds widened, close together, distal ones compressed;

fourth toe longer than third with 29-30 lamellae, all close together, basally compressed, longer distally.

Color: A broad median yellow stripe covering halves of the two median rows of scales, extending from tip of snout to tip of tail; two brown bands bordering yellow line extending onto base of tail, commencing on second supraocular; a narrow yellow line on outer part of supraocular, can be traced to above arm-insertion; a faint darker line below it on occiput and neck; sides with indistinct traces of lines on lateral scalerows; sides of tail pigmented, occasionally showing flecks or small spots distally; underside greenish white, somewhat iridescent on chin.

Measurements in mm.: Snout to vent, 36.5; tail, 40 +; width of head, 5; length of head, 11; snout to arm-insertion, 16; axilla to groin, 19; arm, 10.8; leg, 14.2.

Variation: B. M. No. 1916.6.22.7, Klong Bang Lai, has the sides speckled, the dots scarcely forming rows. The tail is reproduced and there are broad narrow scales above as well as below. There are four nuchals on one side, three on the other; there are three anterior temporals instead of a single one. The ear-opening is much smaller than the palpebral disc. There are seven supralabials, and 28 scalerows.

Distribution: M. Smith reports the species in Thailand from "Tasan, Isthmus of Kra; west of Kanburi [= Kanchanaburi]; Pran; Chantaboon [= Chanthaburi]; Raheng district; Meh Lem, Meh Wang in N. Siam." Outside of Thailand it occurs in Southern Burma, Malaya and the western part of the Indo-Australian Archipelago.

Remarks: This species is arboreal and ranges from sea-level to 1500 m. in the mountains. I have observed occasional specimens at some elevation in trees but they were inaccessible to me, and escaped by going higher or entering cavities. Occasionally the lateral black stripes are reduced, and rarely are absent.

Leiopisma vittigerum microcerum (Boettger)

FIG. 90

Lygosoma (*Leiopisma*) *microcerum* Boettger, Ber. Senckenb. Naturf. Ges., 1901, p. 49 (type-locality, Phuc-son, North Annam).

Lygosoma vittigerum kronfanum M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 4, 1922, p. 208 (type-locality Daban, Langbian Plateau, South Annam); Schmidt, Copeia No. 168, 1928, p. 80.

Leiopisma vittigerum microcerum: M. Smith, The Fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 308.

Diagnosis: Five light buff dorsal and dorsolateral stripes separated by black stripes; ear-opening very large; 30-32 scales around body; tail orange.

Description of species (from 34933, Sanoi River, Ubon province, Thailand): Snout somewhat pointed, twice as long as eye; rostral wider than high forming a broad straight suture with frontonasal; nostril in a small nasal; frontonasal about as wide as long; prefrontals broadly in contact (that on left side abnormal, partly fused to frontal); frontal relatively small, pointed behind, shorter than its distance from end of snout and distinctly shorter than its distance to first nuchal; frontoparietal divided; interparietal triangular; parietals forming suture behind interparietal; four pairs of nuchals, first pair not touching on mesial line; two loreals, subequal in size but anterior slightly higher, and touching both first and second supralabials; two presuboculars; four supraoculars three touching frontal; seven supralabials, fifth is the subocular, sixth separated from large upper temporal by one temporal scale, seventh labial separated also by one scale; seven supraciliaries; lower eyelid with a transparent disc larger than ear-opening; parietal bordered by two temporals; mental with a labial border larger than that of rostral; an azygos postmental; three pairs of chinshield all touching labials, first pair in contact, second separated by one scale, third by three scales. Dorsal scales, larger than others, especially two median rows; 28 scalerows about middle of body; lateral scales smaller than dorsals or ventrals; pair of very large preanals; subcaudals distinctly widened (tip of tail lost). Arms and legs adpressed, toes reach elbows; subdigital lamellae of proximal phalanges somewhat elevated and widened; seven or eight distal lamellae not modified but compressed, forming indefinite keels.

Color in life: A median greenish golden stripe widening at base of tail, becoming orange in color and continuing to tip of tail; this bordered laterally by two wider black stripes that terminate at base of tail but continue as two lateral rows of small spots to tip of tail; greenish white dorsolateral light lines begin anterior to eye, pass across supraoculars and terminate at base of tail; these bordered below by a dark stripe beginning on tip of snout and extending to base of tail; below this a white line, beginning on labials and extending to groin; below this an indefinite darker line terminating in groin; chin, venter, and underpart of tail lacking dark pigment, the tail rosy beneath, orange above and on sides; the white stripes with some slight admixture of dark pigment.

Measurements in mm.: (Nos. 34933 and 34932, respectively). Snout to vent, 35.2, 36; tail, 34 +, ?; snout to ear, 8.3, 8; snout to arm-insertion, 16.5, 14.4; axilla to groin, 16, 16; arm, 10.5, 11; leg, 11.4, 12; head length, 9.8, 10; head width, 5.8, 5.5.

Distribution: Known from Forest Station, Sanoi River, Ubon, Thailand. Elsewhere it occurs in Viet Nam probably also in Cambodia and southern Laos.

Remarks: Specimens were taken at the base of a tree in second growth forest. Others seen escaped by going high in trees.

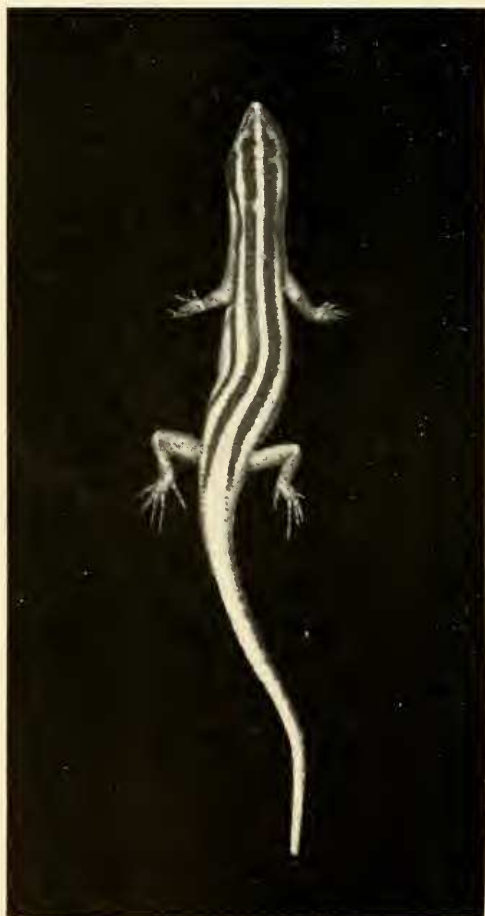


FIG. 90.—*Leiolopisma vittigerum microcerum* Boulenger, No. 34933, Sanoi River Forest Station, Ubon province. Actual snout-vent length, 35.2 mm.

The modification of the subdigital lamellae seems to be an adaptation to climbing.

The type of *microcercum* in the Senckenbergian Museum Frankfurt am Main was examined. The following characters were verified: two pairs of nuchals; two frontoparietals; prefrontal broadly in contact; eye disc large; seven supralabials, fifth directly below eye; interparietal enclosed by parietal; median pair of scales widest; adjoining scalerows also enlarged, and larger than outer bordering rows; 30 scalerows around middle of body; 24 lamellae under fourth toe. The coloration after sixty years of preservation is as follows: a median light bluish green stripe from snout to tail; tail yellowish, two bordering dorsal black lines are lost on tail; the dorsolateral light lines below the black lines begin on eyelids or just in front of them; a lateral brownish stripe begins behind eye and passes above small ear-opening; below this a ventrolateral light stripe, scarcely separable from the whitish ventral coloration; labial sutures with dim brown marks. On sides of proximal half of tail a series of eight rather small diffuse brown spots appear in advance of the regenerated part of tail.

Leiopisma eunice Cochran

FIG. 91

Leiopisma eunice Cochran, Proc. Biol. Soc. Washington, vol. 40, Dec. 2, 1927, pp. 187-188 (type-locality, Bang Suk near Pak Jong, Thailand); Proc. U. S. Nat. Mus., vol. 77, 1930, p. 18, fig. 3, Doi Angka, 700 ft.; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, pp. 1121-1122, fig. 19.

Leiopisma reevesi reevesi: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 295-296.

Diagnosis: Scalerows 32-34 around middle of body; no supranasals; a transparent eye disc; legs short failing to meet by a distance greater than length of arm; lateral stripe broken into 20 to 22 spots between shoulder and groin; dorsum with numerous small rounded spots scattered on all scalerows; one or two pairs of feebly-enlarged nuchals; tail long, nearly one and three-fourths times snout-vent length.

Description of species (from No. 20611, Boonsong Lekagul, Coll.): Body slender; snout narrow; rostral broader than high forming a nearly straight suture with frontonasal; prefrontals forming a median suture, broadly in contact with both loreals; frontal longer than its distance from tip of snout, shorter than length of combined parietals; two frontoparietals, slightly larger than interparietal which is inclosed by large parietals; two median scales following

parietals somewhat enlarged and might be regarded as nuchals; parietals bordered also by a secondary and a tertiary temporal; nasal diagonal, partly or completely divided by nostril, anterior part largest; first loreal much higher than long, curving forward; second loreal somewhat quadrangular; two small preoculars and two pre-suboculars, second wedged between fourth and fifth supralabials; one primary temporal, two secondary and three tertiary temporals; seven supralabials; six infralabials; first pair of chinshields broadly



FIG. 91.—*Leiolopisma cunice*
Cochran, EHT-HMS No. 31785
(4390) Ban Muang Khai, Thali,
Thali, Loei province, Thailand.
Actual snout-vent length, 43 mm.,
total length, 49 mm.

in contact, second pair separated by one, third pair by three scales; four supraoculars, seven supraciliaries.

Eye with a transparent disc; ear-opening large, about two-thirds times diameter of eye; tympanum not deeply sunk; no auricular lobules.

Scales in 32 rows around middle of body, dorsal rows only a little larger than laterals, and equal or slightly smaller than posterior ventrals; a pair of enlarged preanal scales flanked by a smaller pair; fourth toes with 15-17 obtusely keeled lamella below; 92 subcaudals; 78 scalerows between parietals and a point above vent; adpressed arm and leg separated by about 18 transverse scalerows.

Color in life: Above olive, with scattered small black spots on all scalerows suggesting dim lines since space between spots is slightly darker; outer scalerow on dorsum somewhat lighter but no distinct stripes present; a narrow black line on side of snout, continues behind eye to a considerable distance on tail but becomes broken up into more than twenty spots on side and even more on tail, the spots completely or partially separated by golden or vertical cream lines; chin and venter somewhat dirty greenish white, the greenish color more pronounced posteriorly under tail.

Measurements in mm.: Snout to vent, 41; tail, 72; length of head, 9; width of head, 5; snout to ear, 7; snout to arm-insertion, 13.2; axilla to groin, 24; arm, 7.2; leg, 12.

Distribution: Known from "Pak Jong (= Pakchong), Dong Paya Fai Mts."; Doi Angka", Mai Hong Son, and Loei.

Addenda: Three specimens were examined in the British Museum: No. 1916.3.26.27 and 1916.27.29. The first specimen is the largest and measured 48 mm. snout to vent. The prefrontals form a board suture and there are 32 scalerows, and two pairs of nuchals. No. 1916.3.27; in this there are three pairs of small nuchals, the prefrontals are separated and there are 30 scalerows around middle. The lateral stripe is broken into 27 spots on the body. The legs fail to touch by 5 mm. \pm ; the snout-vent length is 47 mm. These are both from Pakchong near the type locality. One specimen, No. 1916.27.29, from Krabin, Siam, has five pairs of small nuchals. The ear-opening is nearly the size of the eye-opening.

Leiolopisma smithi Cochran

Leiolopisma smithi Cochran, Copeia, 1941, No. 4, Nov. 21, 1941, pp. 238-239, fig. 1 (type-locality, Kuhn Tan, ?Lampang province, Thailand).

Diagnosis: Dorsal scales distinctly larger than laterals in six rows across back, the gradation into lateral scales not abrupt; three rather irregular pairs of nuchals; snout moderately short, obtusely rounded; no light vertebral stripe; 28 scalerows about middle of body; venter not white. Allied to *Leiolopisma doriae* but differing in ventral coloration, shorter frontal, and in wide contact between prefrontals.

Description of species (from type description): Distance between end of snout and arm-insertion contained one and one-half times in axilla to groin distance; no supranasals; frontonasal much broader than long, widely separated from frontal by prefrontals which are widely in contact; frontoparietal divided; an interparietal; frontal

three fifths as long as frontoparietals and interparietals together; parietals forming a short suture behind interparietal; three rather irregular pairs of nuchals; seven supraciliaries; four large supraoculars; seven supralabials, fifth and sixth below eye; ear-opening much larger than palpebral disc; no lobules; body scales smooth, the dorsals twice as long and twice as wide as laterals; 28 scalerows around body, six across back between lateral dark stripes; a pair of enlarged median preanals; tail reproduced; adpressed limbs barely fail to meet; digits long, 18 smooth lamellae or very bluntly keeled lamellae under fourth toe.

Color in alcohol: Dorsum metallic sepia; a dark clove-brown dorsolateral line beginning at nostril continuing behind eye, above ear and along sides to tail, interrupted behind axilla so that it appears as a series of irregular dark spots on posterior body and beginning of tail. Venter immaculate drab-gray; sides of head, lips, upper surface of arms and legs heavily spotted with clove-brown.

Measurements in mm.: Head and body, 48; width of head, 6; head length, 10; tip of snout to arm-insertion, 18; tail (part reproduced), 56; axilla to groin, 28; arm, 11; leg, 16.

Distribution: Known only from the type-locality.

Remarks: Dr. Cochran suggests that two specimens reported by Dr. Malcolm Smith from Doi Suthep, referred provisionally to *L. doriae* may belong here. If this is true *doriae* would be deleted from the Thai list of species.

Leiolopisma tavesae M. Smith

Leiolopisma tavesae M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 298 (part.) (type-locality, Bong Tee Valley west of Kanburi [= Kanchanaburi] Thailand); Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, p. 1042 (listed only).

Diagnosis: A small leiolopismid; two frontoparietals; 24 (28) scalerows around body; limbs short, failing to touch when adpressed by a distance nearly equal to the length of arm; snout to vent length, 38 mm. No nuchals; eight supraciliaries; preanals large; anterior loreal larger than posterior or subequal.

Description of species (from the type, British Museum No. 1933.12.1.1): Rostral broadly visible from above forming a broad suture with frontonasal; latter much broader than long, touching loreal laterally, forming a suture with frontal, and separating prefrontals; frontal narrowed posteriorly, its length much greater than its distance from tip of snout, shorter than its distance from posterior

end of parietal; no widened nuchals; nostril in a single nasal; a single large loreal (fusion of first and second), followed by two small superimposed preocular scales normally present in the genus; three small presuboculars; four supraoculars; eight supraciliaries; three or four small postsuboculars; one anterior, two large secondary, and three tertiary temporals; seven supralabials, fifth below median part of eye; lower eyelid with a transparent disc; ear very large, tympanum rather superficial, much larger than transparent disc, its diameter (1 mm.) much smaller than length of eye; mental border on lip greater than that of rostral, followed by a large postmental, in turn followed by paired chinshields in contact, a second pair separated by one scale, and a third pair separated by three scales.

Scalerows around body at middle, 24;* about 64 scales from parietal to a point above vent; two large preanals extending distinctly farther posteriorly than adjoining scales; subcaudals, 81, median row a little larger than adjoining rows but not distinctly widened transversely; arm and leg small, failing to overlap by nearly length of arm; third and fourth fingers of nearly equal length, each with eight lamellae; leg longer than arm, fourth toe considerably longer than third, and with 14 or 15 lamellae.

Color: Above light brown with indistinct darker lines of spots suggesting dim lines on back, the marks continued dimly onto tail; a somewhat wider more distinct line from nostril to eye, and from eye along dorsolateral region of body; sides of neck and lower parts of sides with lines of darker dots indicated. Whitish below.

Measurements in mm.: Snout to vent, 40.2; tail, 64; width of head, 5.2; length of head, 10; snout to arm insertion, 13; axilla to groin, 23; arm, 7; leg, 10.2.

Variation: Two other specimens were referred by M. Smith to this species, one of which is from somewhere in peninsular Thailand. It differs in having 28 scalerows around middle of body instead of 24; there are certainly 2 distinct loreals both a little lower than the single one of the type of *tavesae*; a pair of nuchals are present while there are none in *tavesae*. There are 69 scales from parietal to above vent. The ear-diameter is .7 mm., the eye length 1.4 mm.

The color appears to differ in that on each side of the back there is a dorsolateral lighter line extending from the eye along body and on to tail (but most of tail broken and lost); between these two lines there are six distinct brown dotted lines. The darker

* I count only 24 scalerows around middle of body; also I find only one instead of two loreals.

lateral stripe is two scales wide and (perhaps a third scalerow is slightly darker also), below which the ground color is light brown and the scalerows bear rows of dots indicated even on outer ventral row. The sides of the neck also have distinct rows of dots.

There is enough difference between these specimens as to cause one to question whether they should all be regarded as the same species.

A third specimen presumably of this form is mentioned, from Pegu, Burma. Of this specimen Dr. Smith says, "The loreals are as in the second specimen but in other respects it agrees with the type." This specimen I have not seen.

Distribution: Known only from the above mentioned localities.

Leiolopisma kohtaoensis Cochran

Leiolopisma kohtaoensis Cochran, Proc. Biol. Soc. Washington, vol. 40, 1927, pp. 188-190 (type-locality, Kao Tao, Island Gulf of Siam); Proc. U. S. Nat. Mus., vol. 77, 1930, pp. 20-21, fig. 5 (three drawings of head); M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 296-297.

Diagnosis: Limbs well developed, not meeting when adpressed in adults (may touch in young); ear-opening oval, little smaller than eye-opening, without lobules; a transparent palpebral disc; no supranasals; two frontoparietals one or more pairs of nuchals; 30 somewhat irregular scalerows around middle of body.

Description of species (from type description): Body elongate, distance from tip of snout to arm-insertion in axilla-to-groin distance one and three-fifths times; snout short obtuse; a transparent palpebral disc; nostril in a single nasal; no supranasals; frontonasals broader than long; prefrontals forming a median suture; frontal two-thirds of length of combined parietals; four supraoculars; seven supraciliaries; frontoparietal divided, the parietals forming a suture behind interparietal; ear-opening oval a little smaller than eye-opening; no auricular lobules; nuchal region with one or more pairs of irregularly enlarged scales; 30 scalerows about body, smooth, rather irregular, so that 31 or even 32 scales may be counted in places; lateral scales smallest; median subcaudals very slightly enlarged except where tail is reproduced; large pair of preanals; when adpressed, limbs separated in adults by a distance equal to length of fingers; 16 lamellae under fourth toe.

Color: Light bronze on dorsum with irregular scattered dark brown spots on top of head and in the centers of some dorsal scales; a dark brown band starting on canthus, passing above ear, widening

on shoulder, and broken regularly by small bars of lighter color invading it; on tail, band lighter and broken up into spots; on sides, below this dark band, pinkish yellow with a quite irregular row of small dark brown dots along the lateroventral line; arms and legs spotted and irregularly banded above. Undersurfaces white, immaculate except for few small brown dots on throat; lips spotted brown.

Measurements in mm.: Snout to vent, 44; tail reproduced, 41; axilla to groin, 24; snout-tip to arm-insertion, 15; arm, 9; leg, 13.

Variation: The length of the prefrontal suture varies a little, and in the young the adpressed limbs touch. The size of the interparietal varies. The nuchals vary, a single pair or three pairs may be present, the type has two. The number of lamellae under the fourth toe varies between 15 and 17.

Distribution: Known certainly only from the island of Koh Tao. Malcolm Smith has tentatively referred a specimen from Nakhon Si Thammarat, having 28 scalerows about the body to this species.

Remarks: The type of *kaotaoensis* (U.S.N.M. No. 72284) has been examined, as well as the paratypes. The dorsal scales of female specimens, distended with eggs seem to be considerably larger than those on males. This is of course due to the fact that in imbricate scales, stretching of the skin exposes more of each scale.

Leiolopisma siamensis Taylor and Elbel

FIG. 92

Leiolopisma siamensis Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1123-1125, fig. 20 (type-locality, Phu Kho Mountain, 522 M. Kan Luang, Na Kae, Nakon Phanom province, Thailand).

Diagnosis: Prefrontals meeting or forming a strong suture; no supranasals; undivided disc on lower eyelid less than one third of the size of ear; preanals enlarged; a pair of small nuchals flanked by a larger one laterally; no spotting on back; about 65 scales from parietal to above vent; two anterior temporals; two secondary temporals; some dark spots on shoulder laterally with a slight dorso-lateral light line present or absent; 34 scalerows about middle of body.

Description of species (from 34934): Rostral large, broadly in contact with frontonasal; latter nearly twice as wide as long touching anterior loreal and nasal laterally; two prefrontals, broadly in contact, touching both loreals; frontal narrowed posteriorly, its length greater than its distance from tip of snout, shorter than combined

parietals; parietals broadly in contact behind interparietal; four large supraoculars, two touching frontal, first in contact with prefrontal; nostril in a single nasal; no postnasal; two loreals, anterior higher and slightly narrower than second; two "preocular" scales, lower much like a third loreal; two presuboculars, nine supraciliaries;

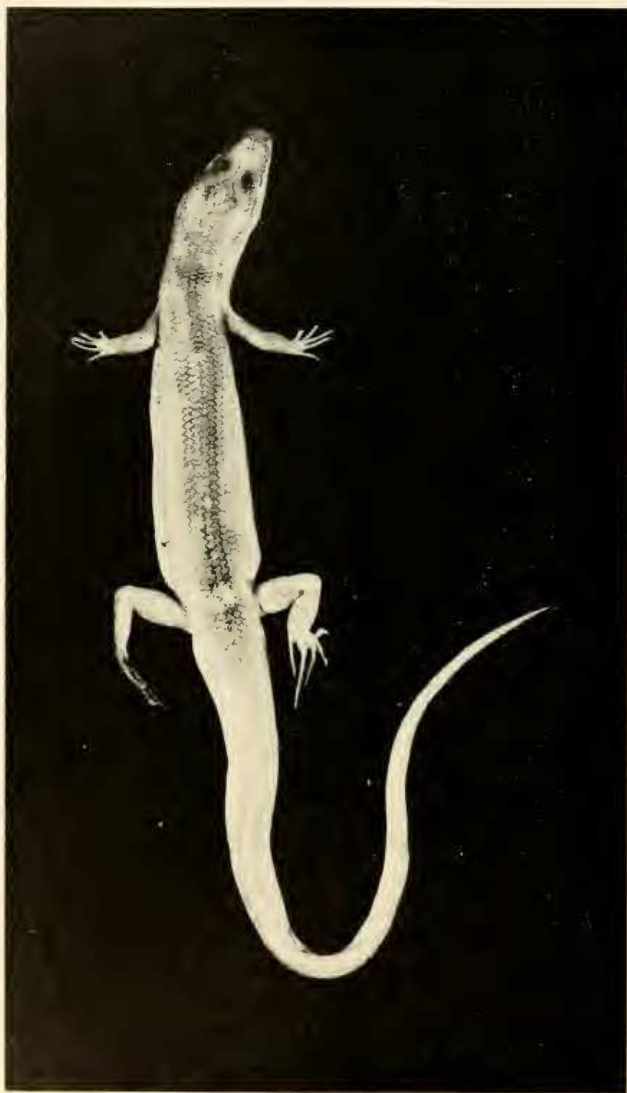


FIG. 92.—*Leiolopisma siamensis* Taylor and Elbel. No. 34934, Forestry station, Sanoi River, Ubon province, Thailand. Actual total length, 131 mm.; snout to vent, 50 mm.

seven supralabials, fifth and sixth under eye, sixth separated from large secondary temporal by two anterior temporals; seventh labial separated from it by one scale; tympanum large, rather deeply sunk, with three minute lobules visible; six infralabials; mental white with a slightly larger labial border than rostral; an azygos postmental; three pairs of chinshields all touching labials, first in contact, second separated by one scale, third by three scales, fourth pair small, scarcely differentiated.

The ear-opening somewhat more than three times as large as transparent disc in lower eyelid; nuchal very small and probably should not be regarded as a true nuchal.

Scalerows, 34 around middle of body, dorsal and lateral scales subequal; about 65 scales from parietal to a point above vent; distal three fourths of subcaudals wider than adjoining scales; 101 subcaudals, distal 37 regenerated and more widened than others. When limbs are adpressed toes reach wrist or a little beyond; 19-20 lamellae under first toe.

Color in life: Rather olive-brown with darker areas in supra-ocular region; faint trace of lateral dark line behind eye to shoulder; dorsolateral light line apparently not present; ventral surfaces whitish, subcaudal region with a wash of pink.

Measurements in mm. of *Leiopisma siamensis*

NUMBER	Type	34934	35017	35016	34903
Snout to vent	51	50	51	48	50
Tail	65*	81*	66.5*	42**	45*
Snout to ear		10	9.6	9.6	10
Head length	13	12.5	11.8	11.6	11.8
Head width	7.3	7.2	7.2	7.2	7
Snout to arm	19	19.2	18.3	18.6	18.2
Axilla to groin	24.5	27	23	23.5	26
Arm	14	13	13	12.8	12.5
Leg	20	19	19	18.2	17.2

* Tails regenerated; ** tail broken.

Distribution: Known from the type locality, Nakhon Phanon, Udon Thani, and Ubon (Nos. 34934, Sanoi River, Ubon; 34903, Ubon City; 35016, 35017, mountain west of Udon Thani, city).

Remarks: One specimen, No. 35016, shows three or four strong dark spots on shoulder in front of arm-insertion and one or two spots posterior to it; there are also very dim spots discernible extending from these to base of tail. Two of the specimens show a

single widened pair of nuchals which is probably the normal condition. All the specimens have the prefrontals broadly in contact.

In the type diagnosis the statement "fifth labial separated from it by one temporal scale" should read "seventh labial separated from it by one temporal scale." In measurements, "axilla to grain" should read "axilla to groin."

Leiopisma melanostictum Boulenger

FIG. 93

Lygosoma melanostictum Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 5, 1887, pp. 479-480 (type-locality Pla-poo, Tenasserim, Burma, referred to the section *Leiopisma*); *ibid.*, ser. 2, vol. 13, 1893, p. 230; The fauna of British India including Ceylon and Burma; Reptilia and Batrachia, 1890, p. 199 (hills of northern Tenasserim, between 3300 and 4000 ft.); ?Flower, Proc. Zool. Soc. London, 1899, p. 650 (38 smooth scales around middle of body [part.]); ?Schenkel, Verh. Ges. Basel, vol. 13, 1901, p. 190; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, June, 1916, p. 56 (part.); *ibid.*, Dec., p. 157 (Nakhon Si Thammarat; scales usually 38).

Leiopisma reevesii melanostictum: M. Smith, The fauna of British India Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, pp. 296-297 (part.)

Diagnosis: A medium sized specimen (50 mm.) with numerous black punctations on back on either side of midline; scales in 36-38 rows; most scales of side of head, neck, flanks, and lower sides of tail with dark flecks tending to form lines. When limbs are adpressed the toe reaches hand but not quite to wrist; frontoparietal divided; no enlarged nuchals; prefrontals broadly in contact; lateral dark stripe begins narrowly near tip of snout, continues onto tail, but partially broken throughout, lower edge very indefinite; 18-19 lamellae under fourth toe.

Description of species (from No. 35906, Doi Suthep, Chiang Mai): Rostral nearly twice as wide as high, forming an elongate, slightly curved suture with frontonasal; frontonasal once and a half times as wide as long, separated from frontal by large prefrontals broadly in contact, touching first loreal laterally; frontal narrowed posteriorly about as long as distance to tip of snout, much shorter than combined parietals; frontoparietals paired; interparietal as wide as long, broadly inclosed by parietals; no broadened nuchals; four supraoculars, two touching frontal, first touching prefrontal; seven supraciliaries; lower eyelid with a small, somewhat elongate transparent disc; two loreals, anterior the higher and equally as broad as the second; two presuboculars, third wedged between fourth and fifth supralabials; seven supralabials, sixth largest separated from enlarged upper temporal by a single scale, seventh separated from



FIG. 93—*Leiopisma melanostictum* Boulenger. Both from Doi Suthep, Chiang Mai province. Left figure, 35906. Actual total length, 137.5 mm.; snout-vent length, 49.5 mm. Right figure, 33780. Actual snout-vent length, 49.5 mm.

it by one scale also; ear large, tympanum not deeply sunk lacking lobules; scales in 36 rows around body; scales of postoccipital region scarcely wider than on back; eight scalerows between lateral dark stripes; six infralabials, the fifth largest; an azygos postmental and four pairs of chinshields, first pair touching, second separated by one scale, all in contact with infralabials; adpressed arm and leg overlap the length of fingers; 19 lamellae under fourth toe; subcaudals on distal three fourths of tail wider than adjoining scales; 76 scales from parietals to a point above vent.

Color: Above dark brown with very numerous small black dots; a slightly lighter brown dorsolateral line extending onto shoulders confined to one scalerow which is separated from its fellow by six scalerows; dark flecks on most of dorsal head scales; a lateral line beginning narrowly on snout passing partly above eye and ear-opening and continuing on side of body and less distinctly along sides of tail the lower edge rather indefinite throughout, and bearing scattered distinct light spots or indefinite lighter areas. Scalerows of sides, neck, side of head, and tail bearing numerous dark flecks sometimes encroaching on ventral area; seven ventral scalerows whitish lacking spots; chin scales and underside of neck with a few flecks. Arms and legs reticulated, enclosing lighter spots and areas.

Table of data on *Leiopolisma melanostictum*

NUMBER (sex)	33780	35906 ♀	3680 ♂	3681
Snout to vent length.....	49.5	52.5	49	43
Tail length.....		85		
Snout to arm insertion.....	18	16.7	17.6	15
Axilla.....	27.8	30	28	23
Arm.....	12	12.7	14	11
Leg.....	19.8	19	19.6	17
Scales around middle.....	36	36	36	36
Scales parietal to above vent.....	74	76	74	75
Lamellae 4th toe.....	19	19	19	19-20
Prefrontals, broad contact.....	yes	yes	yes	yes
Nuchals.....	no	no	no	no

Variation: The table shows variation. The females appear to have a slightly longer axilla to groin measurement.

Distribution: The species occurs in the mountain ranges along the boundary of Burma and Thailand and usually at an elevation between three and four thousand feet. My specimens are from Doi Suthep, Chiangmai province. I have not seen the specimen re-

ported from Bangkok and "Chantaboon" but suggest that these be re-examined.

Remarks: I do not consider this form to be a subspecies of *reevesii*.

Leiopisma rupicolum (M. Smith)

FIG. 94

Lygosoma rupicola Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, 1916, pp. 45-46, pl. fig. 3 (type-locality, Chong Kae, near Paknampo, central Thailand).

Leiopisma rupicola: The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. II, Sauria, Feb. 7, 1935, p. 297; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, Mar. 20, 1958, pp. 1119-1121, fig. 18 (Nakon Phanom).

Diagnosis: A disc on eye much smaller than large ear-opening; leg reaches beyond elbow of adpressed arm; no supranasals.

Description of species (from No. 33338 near Muk Lek, Nakhon Ratchasima prov.: Snout obtusely pointed. Rostral broadly visible above, forming a straight suture with frontonasal; prefrontals large, broadly in contact, touching both loreals equally; four supraoculars, two in contact with frontal; frontal as long as its distance from tip of snout, shorter than frontoparietals and interparietal together; narrowed to a point posteriorly; frontoparietals distinct, a little larger than interparietals; latter scale enclosed by parietals; no elongate nuchals following parietals but a series of larger scales border them between temporals; nostril in a single nasal scale; two large loreals, anterior the higher; two preoculars, lower largest, and two presuboculars, the latter one wedged between the fourth and fifth supralabials; seven supralabials, fifth, below eye, largest; six or seven infralabials; ear-opening much larger than eye-disc; dorsal scales about size of those on venter, but a little larger than lateral scales; no lobules projecting from edge of ear. Thirty-six scalerows around middle of body; legs and arms strongly developed, adpressed leg reaching beyond elbow of adpressed arm; 17 obtusely keeled lamellae under fourth toe; four enlarged preanal scales, two median distinctly the larger; 119 subcaudal scales; 71 scales from parietals to above vent.

Color in life: Above brown-olive to light brown covering median eight scalerows, outer rows a little lighter; laterally an indefinite dark line, varying in width, extends from eye backwards on side and reaches somewhat onto tail; top of head darker with some indefinite dark spots; two rows of dark spots on two median dorsal scalerows.

The lateral band is continuous anteriorly but on shoulder and sides it breaks up into spots separated by areas of lighter color; tail pinkish-olive growing more pink posteriorly; chin whitish; venter pinkish lavender, underside of tail yellowish, becoming pinkish towards tip; labials with faint dark marks along sutures; arms and legs mottled with dark brown or blackish, and light olive; below, limbs flesh with a slight yellowish wash.

In alcohol venter is largely violet, the subcaudal region pure white.

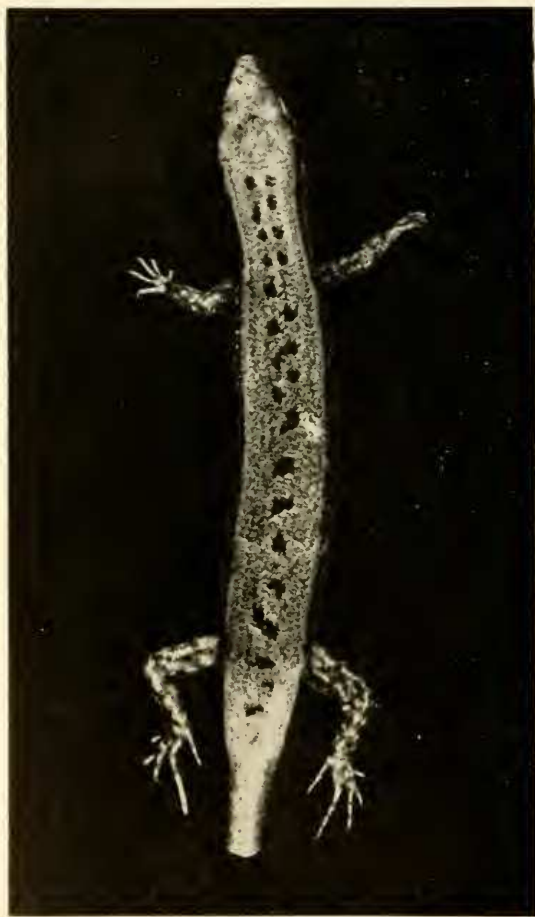


FIG. 94.—*Leiolopisma rupicolum* M. Smith. No. 786, Khao Phra Vihan, Ubon province, Thailand. Actual total length, 65 mm. to end of broken tail.

Measurements in mm.: Snout to vent, 38.5; tail, 65.5; width of head, 6; length of head, 9; snout to ear, 8; snout to arm-insertion, 15.4; axilla to groin, 19; arm, 11; leg, 17.

Variation: While the lateral coloration remains rather constant, the distribution of the spotting on the back varies considerably; the largest number of specimens have a double row of spots on the back anteriorly, the spots tending to fuse to make a single row posteriorly; one specimen from Sanoi River, Ubon, has a double row of spots anteriorly but from the middle of the back they are united to form a single median line that extends to near the tip of the tail. The supraocular areas are blackish. The other specimens show no lines or spotting on dorsal side of tail. The lamellae under the fourth toe varies between 17 and 19; the scales around the body vary between 34 and 36.

The largest specimen taken is from Khao Phra Vihan. It measures 53 mm. snout-to-vent. The part of the tail remaining has been regenerated. It is remarkable in having a series of broad, rather narrow scales in the subcaudal region, and a similar series on the dorsal part of the tail equal in size to the subcaudals—all symmetrical. Another feature of this specimen is a small symmetrical scale behind the frontal in contact with the second and third supraoculars. Since the frontal normally touches only the first two supraoculars one presumes that the scale is, at least, partially segmented from the frontoparietals.

Distribution: The species is known from the type locality Ubon, Nakhon Phanom (522 m. on Phu Kho), Udon Thani, Sara Buri and Sisaket. Dr. Smith reports it also from "Hin Lap, Dong Paya Fai Mts. at 200 ft.; east Siam; and Huey Sapan, northeastern Siam." The specimen here described is from Pasadet, Sara Buri. Outside of Thailand it is known from the Langbian plateau in Annam.

Remarks: I have examined certain specimens from the Langbian Plateau. The specimens were marked much like *Sphenomorphus stellatus* that may occur in the same area. One specimen shows a light median streak, the dorsal spotting much reduced and a tiny pair of nuchals is present (B. M. 1935.11.5.B).

A specimen from northeastern Siam (Huey Sapon) (B. M. 1933.12.1.10.11) has the prefrontals separated and 16 lamellae under the fourth toe.

Leiolopisma doriae (Boulenger)

Lygosoma doriae Boulenger, Ann. Mus. Civ. Genova, ser. 2, vol. 4, 1887, p. 620 (type-locality, hills west of Bhamo, Burma); The fauna of British India . . . Reptilia and Batrachia, 1890, p. 201; Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 54, 1927, p. 502.

Leiolopisma doriae: Smith, The fauna of British India including Ceylon and Burma, Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 302-303.

Diagnosis: Three or four pairs of nuchals; seven or eight supraciliaries, 28-32 smooth scales round middle of body; a pair of large preanals; adpressed limbs do not quite meet or may reach wrist; two frontoparietals, tail one and three-fourths times length, snout to vent; with transversely enlarged subcaudals.

Description of species: Distance between the end of snout and arm-insertion one and one-third to one and two-thirds times in distance between axilla and groin; prefrontals narrowly separated or barely touching; frontal about as long as its distance from first nuchals; three or four pairs of nuchals; seven or eight supraciliaries; auricular opening much larger than the palpebral disc, without projecting lobules or granules. Body scales smooth, the dorsals not twice as large as laterals; 26-28 scales about middle (28-32 *file* M. Smith), six across back; a pair of large preanals; tail one and three-fourths times as long as head and body; with transversely enlarged subcaudals; the adpressed limbs do not meet or may reach as far as wrist; digits long, 16-18, keeled lamellae beneath fourth toe.

Color: Bronze-brown or golden brown above with numerous small black spots; a dark brown stripe along the upper half of the flank and neck, much broken up by lighter spots; lower parts of flanks with small black spots; whitish below.

Measurements in mm.: Snout to vent, 58; tail "one and three-fourth times as long as head and body." 101. (After Boulenger, F. B. I. 1890).

Remarks: This species is included in the Thai fauna on the basis of two very young specimens from Doi Suthep, provisionally referred to this species by Malcolm Smith. This form has been reported from "Annam" by Bourret. This may be a questionable record, and I consider it doubtful that it occurs in Chiang Mai.

While visiting the Senckenbergian Museum in Frankfurt I examined the type (No. 14685) and recorded the following data: a narrow frontonasal wider than long touches frontal separating the prefrontals; frontal as long as its distance from snout, shorter than parietals and frontoparietals combined; frontoparietal divided; a small interparietal enclosed by parietals; three and one-half pairs

of nuchals; nostril a little behind suture of rostral and frontonasal; four supraoculars; six supraciliaries; one anterior temporal; two secondary temporals, the upper very large; two tertiary temporals, the two large; upper secondaries narrowly separated from each other; two loreals both same height; two presuboculars; seven supralabials the fifth below the eye; transparent disc in eyelid as large or larger than ear-opening; two large preanals; subcaudals, after six paired basal scales, distinctly widened; 16-17 lamellae under fourth toe.

Very nearly uniform brown-olive on dorsum with some brown flecks on dorsum and sides of tail; leg and foot with brownish marks; a brown line from nostril through eye and along side; dark brown area on upper arm and small bars on hand and fingers.

Genus *LYGOSOMA* Hardwicke and Gray

Lygosoma Hardwicke and Gray, Zool. Journ., vol. 3, 1827, p. 228 (type of genus *Lacerta serpens* = *quadrupes*).

Diagnosis: Palatine bones in contact mesially; ear-opening reduced; limbs pentadactyl but greatly reduced in size and widely separated.

Only a single species, *Lygosoma quadrupes* (Linnaeus) of this genus is recognized in Thailand.

Lygosoma quadrupes (Linnaeus)

FIG. 95

Lacerta chalcides Linnaeus, Systema Naturae, 12th ed., 1766, p. 369.

Anguis quadrupes Linnaeus, Systema Naturae, 12th ed., 1766, p. 390 (type-locality, Java).

Lygosoma quadrupes: Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 16; M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 290-291.

Scincus brachypus Schneider, Historiae amphibiorum naturalis et literariae, fasc. 2, 1799, p. 192.

Seps pentadactylus Daudin, Histoire naturelle générale et particulière des reptiles, vol. 4, 1802, p. 325.

Lygosoma abdominalis Gray, Ann. Mag. Nat. Hist., vol. 2, 1839, p. 332 (type-locality, India, Java).

Lygosoma brachypoda Duméril and Bibron, Erpétologie générale . . . , vol. 5, 1839, p. 721 (type-locality, Java).

Lygosoma chalcides: Gray, Catalogue of the specimens of lizards . . . , 1845, p. 88; Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 340; A vertebrate fauna of the Malay Peninsula . . . Reptilia and Batrachia, 1912, p. 97; M. Smith, Journ. Nat. Hist. Siam, vol. 2, Dec. 1916, p. 157 (Nakhon Si Thammarat, "Bangnara, Patani"); *ibid.*, June, 1961, p. 56 ("widely distributed, not uncommon in Bangkok").

Lygosoma (sec. *Lygosoma*) *quadrupes*: M. Smith, Rec. Ind. Mus., vol. 39, 1937, p. 221.

Diagnosis: A slender, diminutive skink, with four very short limbs and an elongate body; prefrontals separated; frontoparietal single; ear-opening minute, partly covered with scales; 24 to 26 scalerows around middle of body; five lamellae under fourth toe. The color is gray-brown to brown, with dark longitudinal lines, usually visible on edges of all scalerows, continued onto tail.

Description of species (from No. 33423, Bangkok): Body slender, head bluntly pointed; rostral little wider than high, frontonasal broader than long, forming suture with rostral, frontal, and anterior loreal; prefrontals small, widely separated; frontal little longer than wide, little longer than its distance from tip of snout, about as long as single frontoparietal, but smaller; interparietal a little smaller than frontal, pointed posteriorly, enclosed by parietals; nuchal present on right side (broken in two on left); nasal single; no postnasal; anterior loreal higher but narrower than second loreal; small preocular with a continuous series of pre-, sub-, and postoculars the anteriormost largest; four supraoculars, three touching frontal; two anterior temporals, upper touching parietal; six supraciliaries; seven supralabials, anterior longest; six infralabials; mental with a longer labial border than rostral; an undivided postmental; first chinshields in contact; second pair separated by one scale; third pair only slightly enlarged, separated by three scales, and separated from labials by a small scale.

Twenty-six scalerows around middle of body, scales subequal; 115 transverse rows between parietals and a point above vent; subcaudals 106 (the extreme tip $4\frac{1}{2}$ mm. regenerated); six preanal scales, two median largest.

Ear-opening narrow, partly covered with scales; lower eyelid movable, covered by two rows of scales. Arm short; four lamellae under three longest fingers, six under longest toe, three median toes nearly same length. Length of arm in axilla-to-groin measurement, eleven times.

Color in life: Above violet-brown to violet with darker lines bordering edges of all scalerows, somewhat less distinct above, more distinct on sides and venter where ground color is whitish or white, the dark lines continuing to tip of tail. Upper labials rather dark, the color not uniform and sutures may be lighter. Top of head darker than body; lower eyelid nearly yellow-white.

Variation: A specimen taken at a point 2 km. west of Kanchanaburi, Kanchanaburi province in a limestone hill showed certain differences which may be of some significance. The specimen is a

large female measuring 68 mm. snout to vent, with a scale count (parietal to above vent) of 121, six more than appear in other specimens examined. The arm measures 3 mm.; the axilla-to-groin measurement is 54.

The specimen, however, has very short arms and legs when compared with specimens from Bangkok, and Ang Hin, Chon Buri province, although in many, if not all skinks the limbs when present attain their growth earlier and seemingly fail to grow at their

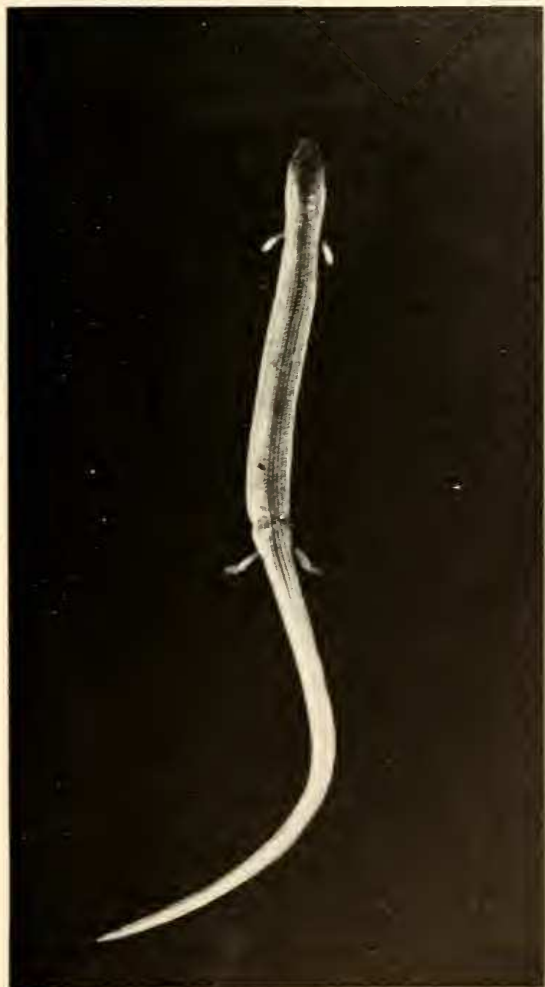


FIG. 95.—*Lygosoma quadrupes* (Linnaeus). No. 4029, Ang Hin, Chon Buri, Thailand. (Young.) Actual length, 95 mm.

Measurements in mm. and scalecounts of *Lygosoma quadrupes*

NUMBER	33423	33282	33473	33540	33113
Snout to vent.....	59	50	68	61	43
Tail.....	68*	54*	64*	69*	37*
Width of head.....	4.1	3.7	4.6	4.2	3.7
Width of body.....	4.1	3.7	5.2	4	3.7
Snout to ear.....	5.7	5.6	6.3	6.1	5.4
Snout to arm insertion.....	12	11.2	12.2	12	9.3
Axilla to groin.....	44	37	54	42	29.4
Arm.....	4	3.25	3	3.6	3.1
Leg.....	4.9	4.6	4.3	5	4.8
Scales parietal to vent.....	115	115	121	115	114
Subcaudals.....	106*	109*	96*	118	89*
Scales around body.....	26	28	26	24	26

Nos. 33423, 33540, Bangkok; 33282, 33113, Ang Hin, Chon Buri; 33473, Kanchanaburi.

* Incomplete tails.

regular rate after adult size is reached. However, in this specimen the arm is as short as that of a specimen with a snout-vent length of only 43 mm. The fingers are relatively shorter also. The coloration of the venter is nearly pure flesh with the longitudinal lines only showing dimly at sides of venter; the subcaudal region also is rather light in color.

Scalerows vary from 24 to 26 around the body in the series examined.

Distribution: This species has been found in Thailand in the following provinces: Sara Buri, Ayutthaya, Phra Nakhon, Kanchanaburi, Pattani, Yala, Chon Buri, Nakhon Si Thammarat, Prachuap Khiri Khan, Songkhla, and Trang. Why it should seemingly be absent in the central and eastern parts of Thailand is difficult to explain since it occurs outside of Thailand in South China, Indo-China, Malay, the Indo-Australian Archipelago as far east as Palawan in the Philippine Islands.

Genus SAIPHOS Gray

Saiphos Gray, in Griffith's Cuvier's Animal Kingdom, vol. 9, 1831, Synopsis, p. 72 (type of genus *aequalis*).

Diagnosis: An undivided transparent disc on lower eyelid; no supranasals; no auricular opening but a depression in position of ear; limbs pentadactyl short, not overlapping when adpressed.

The species has been found only once in Thailand.

Saiphos quadrivittatum (Peters)

Lygosoma (*Cophoscincus*) *quadrivittatum* Peters, Monatsb. K. Akad. Wiss. Berlin, 1867, p. 19; *ibid.*, 1872, p. 583 (type-locality, Mindanao, P. I.); Boulenger, Catalogue of the lizards in the British Museum, vol. 3, 1887, p. 329; Fascioli Malayenses, Zoology, vol. 1, 1903, p. 159 ("Bukit Besar, Patani States"); The fauna of the Malay Peninsula, from the Isthmus of Kra to Singapore; Reptilia and Batrachia, 1912, pp. 95-96; M. Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, June, 1916, p. 56 (Bukit Besar, "Patani States" = Pattani); Bull. Raffles Mus., no. 3, 1930, p. 38.

Saiphos quadrivittatum; de Rooij, The Reptilia of the Indo-Australian Archipelago . . . , vol. 1, 1915, p. 271; Taylor, The lizards of the Philippine Ids., 1922, p. 223.

Diagnosis: Diminutive skinks, snout to vent, 37 mm.; limbs pentadactyl, not meeting when adpressed; lower eyelid with an undivided transparent disc; no supranasals; single frontoparietals; small frontal; three to four pairs of nuchals; ear hidden; 18 to 20 scales about body.

Description of species: Distance between end of snout and arm-insertion one and one-half times in distance between axilla and groin; limbs well developed, pentadactyl, not meeting when adpressed; snout rather pointed, frontonasal touching rostral; no supranasals; prefrontals small, separated; frontal scarcely longer than single frontoparietal; parietals forming a suture behind interparietal; three or four pairs of nuchals. Fifth supralabial below eye; auricular opening hidden under scales, indicated by a depression; nostril in a single nasal; 18 to 20 smooth scales around body at middle, two dorsal rows largest; two preanals slightly enlarged; digits slender, fourth toe longest, with 15-16 lamellae on undersurface; lower eyelid with an undivided disc. Tail thickened a little shorter than head and body; limbs rather short, overlapping when adpressed.

Color in life: Yellowish or yellowish orange to pale brown above, with four blackish longitudinal stripes, median pair extending to supraoculars; lateral pair extends to eyes; digits with dark cross-bars; undersurface yellowish or brownish white; lips, chin, sides of head, and neck spotted with black; tail dark spotted, the spots sometimes making vertical bars on side.

Measurements in mm.: Snout to vent, 37; tail, 35.

Distribution: The species is included in the fauna of Thailand on the basis of a collection made in the extreme southern part of Thailand at "Bukit Besar, Patani States."

It is a widespread species, being known in Malaya, Borneo, Australia, Celebes, and the Philippine Islands.

Ophioscincus Peters

Ophioscincus Peters, Mon. Akad. Berlin, 1873, p. 747 (type *australis*).

Typhloseps Angel, Bull. Mus. Hist. Nat. Paris, 1920, p. 4 (type *roulei*).

Diagnosis: Palatine bones in contact mesially; pterygoid bones in contact anteriorly, palatal notch far back in mouth; maxillary teeth conical; no pterygoid teeth. Eye small, lower eyelid composed of one or two thickened scales, probably immovable; no upper lid. Nostrils situated in anterior part of a very large nasal; no supranasals; frontonasal present; frontoparietals distinct; no ear-opening. Body vermiform; no limbs; vestiges of pectoral and pelvic girdles.

Two species of this genus are known in Thailand. These are *Ophioscincus anguinoides* and *Ophioscincus roulei*. They may be distinguished by the following key:

KEY TO THAI SPECIES OF OPHIOSCINCUS

Nasal shields separated or barely touching one another; 22 to 24 scales around body	<i>anguinoides</i>
Nasal shields broadly in contact; 18 scalerows around body	<i>roulei</i>

I have been unable to accept the placing of Lönnberg's *Isopachus* as a synonym of this genus as proposed by Malcolm Smith. While I am certain that *roulei* and *anguinoides* are congeneric I am not wholly certain that they in turn are congeneric with the Australian *australis*. This placement acknowledges an enormous gap in the continuity of distribution of this genus.

Ophioscincus anguinoides Boulenger

FIG. 96

Lygosoma anguinoides Boulenger, Journ. Nat. Hist. Soc. Siam, vol. 1, 1914, p. 67 (type-locality, Bangtaphan, "Patiyu State" Siam = Prachuap Khiri Khan province); Smith, Journ. Nat. Hist. Soc. Siam, vol. 2, no. 1, 1916, p. 56; *idem*, Dec. 1916, pp. 157-158; Cochran, Proc. U. S. Nat. Mus., vol. 77, 1930, p. 16 (Koh Tao [island] Gulf of Siam).

Ophioscincus anguinoides: Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, 1935, pp. 334-335 (Hat Sanuk, Klong Bang Lai, Bangtaphan, Maprit, localities between 10° 50' and 12° N. Lat.).

Rhodona anguinoides M. Smith, Rec. Ind. Mus., vol. 39, p. 231.

Diagnosis: No limbs; body slender; tail about as long as head and body, ending in a point; no supranasals; frontonasal present, large; nasals touching or barely separated; frontal about size of frontonasal; prefrontals present, widely separated; frontoparietals broadly in contact, each as large as interparietal; 22-24 scales about

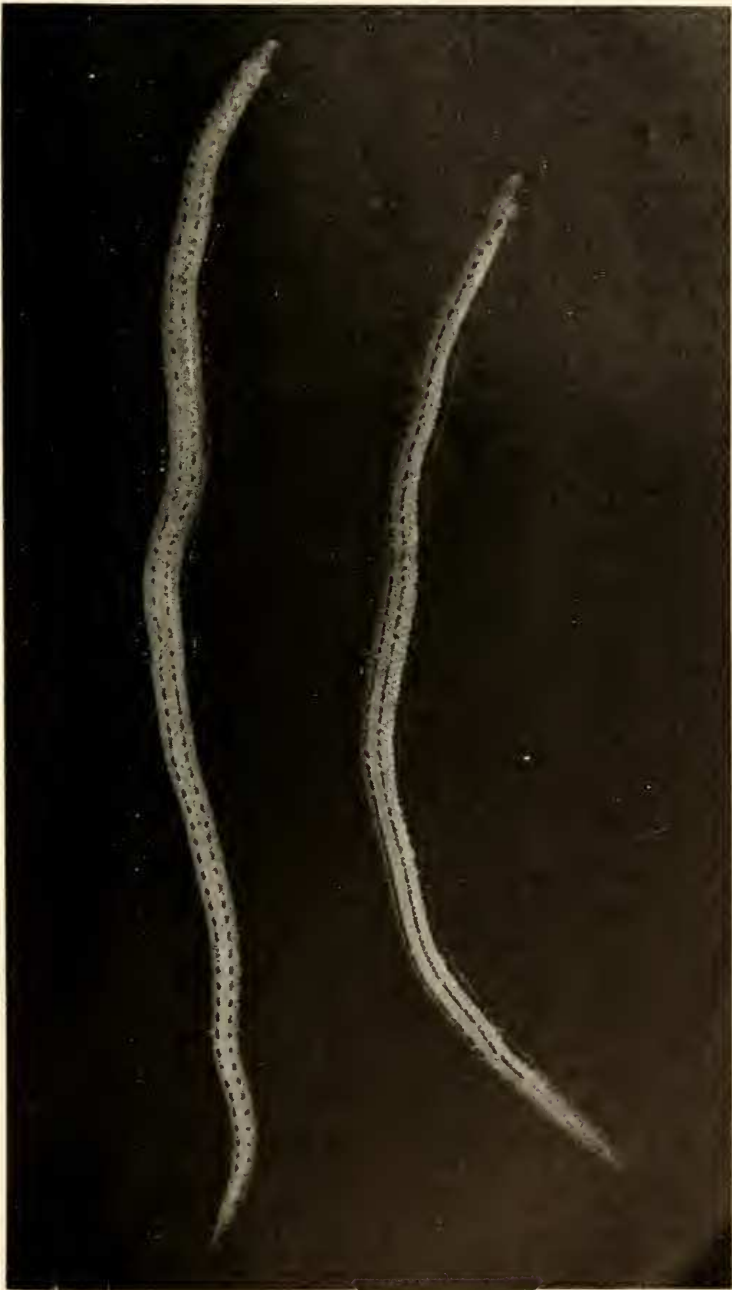


FIG. 96.—*Ophioscincus anguinoides* (Boulenger). Left figure, No. 606, Hua Hin, Prachuap Khiri Khan, province. Actual total length, 124.5 mm. Right figure No. 604, same locality. Actual total length, 113 mm.

middle of body; preanals enlarged; gray or gray-fawn above with two black dotted lines extending to tail; a dorsolateral dark stripe; venter and subcaudal region with dark lines on edges of scalerows.

Description of species (from No. 606, Hua Hin, Prachuap, Khiri Khan, Thailand): Body slender, head not strongly differentiated from body; rostral large, its apex prolonged backwards onto top of head, forming an angle; nostril pierced near anterior outer edge of nasal, slightly anterior to posteriormost lateral extension of rostral; nasals forming a median suture scarcely more than half length of scale; frontonasal broader than long, slightly angular on anterior border, touching loreal and prefrontal, forming a broad suture with frontal; latter larger than frontonasal, a little wider than long, touching two supraoculars. Frontoparietals large, broadly in contact behind frontal, scales nearly as large as interparietal; parietals slender, diagonally placed forming suture behind interparietal; well-defined pair of nuchals; first labial largest, touching loreal; extending farther back than nasals, followed by four labials, third below eye touching lower eyelid; one presubocular; two post-suboculars; four supraoculars, second widest pushing between frontoparietal and frontal; five supraciliaries; two primary temporals, one primary and one secondary temporal bordering parietals; mental large, its labial border only slightly larger than that of rostral; a large undivided postmental; five infralabials, first not or only slightly larger than fourth; two pairs of chinshields about same size, each separated by a single scale, and each scale in contact with infralabials; third pair of chinshields scarcely differentiated, touching infralabials, separated by five scales; a single ocular scale covers eye, bordered below by three or four granules; 27 scales around neck close behind head; 26 scales around middle of body; 15 scales around tail; two enlarged preanals; 94 subcaudals not or but slightly differentiated; no ear-opening; eye nearly or entirely concealed; head only slightly wider than neck. Rostral, nasals, first supralabials, first infralabials, and mental thickened; snout extending somewhat anterior to lower jaw.

Color: Gray-brown above, with a lateral stripe one and two half rows wide beginning on neck and extending to tip of tail; a pair of dorsal dotted lavender-brown lines, bordering edges of two scalerows, form lines from neck to tip of tail separated by two scalerows; edges of all scalerows on venter and subcaudal areas between lateral lines, more or less dotted with lavender, forming more or less distinct dotted lines, more distinct under tail; head with

numerous flecks above; an irregular black area about and in front of eye and on tip of snout under thickened terminal scales of snout.

Measurements in mm. of *Ophioscincus anguinoides*

NUMBER	603	604	605	606
Snout to vent	62	64	71	62.5
Tail length	44*	49*	?	62*
Total length	106	113		124.5
Width of head	4	4.4	4.4	4.1
Length of head	6.2	7	7	6
Width of body	4.5	4.9	4.5	4.6
Width of tail	4.1	4.3		3.9

* Regenerated.

Variation: My specimens differ but little in color and markings. The scalerows about body of all are 24 (25). Malcolm Smith (1935) reports 22-24. The nasals may be separated; there may be four or five supraciliaries, and four or five supraoculars; the scales about the body are subequal, the largest being on the tail. The dark color may be brown or lavender.

Distribution: The species is known only from a very limited region in peninsular Thailand, between 10° 50' and 12° N. Latitude, chiefly in the provinces of Chumphon and Prachuap Khiri Khan. My specimens were taken at Hua Hin in the latter province near the sea shore on a golf course.

Remarks: These specimens were usually found under piles of rotting grass, or under other debris of various types; some, by digging in soft earth. Some were taken with *Isopachys gyldenstolpei*. (See under that species.) These lizards burrow with rapidity into soft earth. The species is endemic in Thailand and not known elsewhere. They are ovoviviporous.

Ophioscincus roulei (Angel)

FIG. 97

Typhloseps roulei Angel, Bull. Mus. Hist. Nat. Paris, 1920, p. 4, figs. (type-locality, "Siam").

Ophioscincus roulei: M. Smith, The fauna of British India, including Ceylon and Burma; Reptilia and Amphibia, vol. 2, Sauria, Feb. 7, 1935, p. 335; Taylor and Elbel, Univ. Kansas Sci. Bull., vol. 38, pt. 2, 1958, p. 1043.

Diagnosis: Snout flattened anteriorly, somewhat wedge-shaped, the part visible above as long as internasal suture; nasals very large, broadly in contact mesially, the nostril in anterior lower part; a

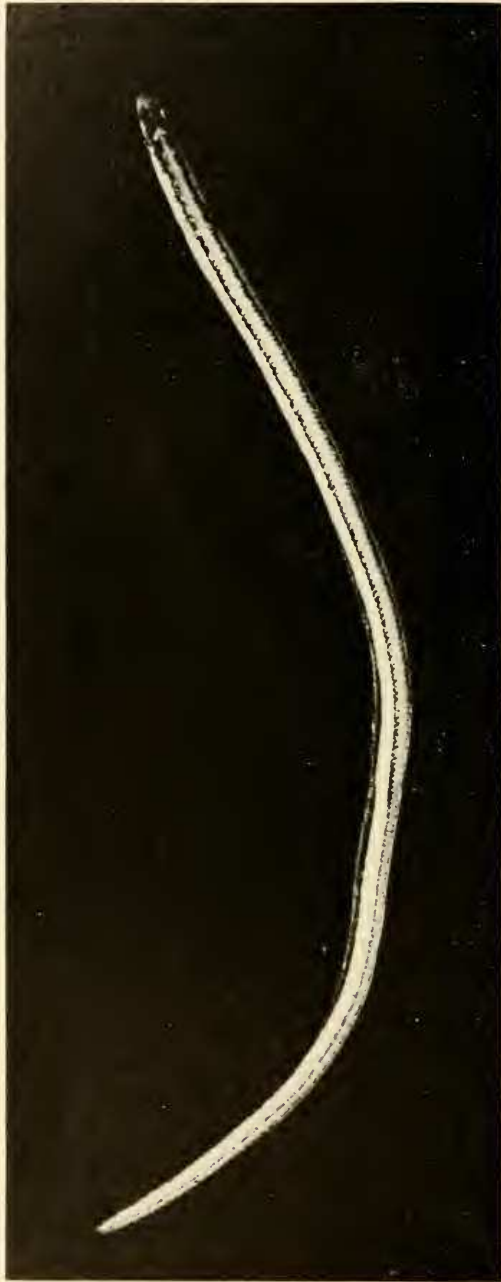


FIG. 97.—*Ophisaurus roulei* (Angel). From Bang Saen, Chon Buri, province. Approximately actual size.

frontonasal; prefrontals present; frontoparietals separated; a vertical depression on each side just back of head; limbs absent; 18 scale-rows; head dark; body fawn to buff with two dark lines from occiput to end of tail; tip of tail blunt. Venter dark, the color extending well up on sides.

Description of species (from No. 33104, Ang Hin, Chon Buri province, Thailand): Snout narrowed, bluntly rounded, somewhat flattened above; rostral thickened, wedge-shaped, part visible above longer than internasal suture, very slightly shorter than nasals; latter large, broadly in contact, a little longer than broad, distinctly thickened, nostril situated in lower anterior part of scale; frontonasal twice as wide as long, touching one loreal laterally; prefrontals very small, widely separated from each other; frontal wider than long, slightly concave on anterior border touching prefrontal and one supraocular laterally, and forming a broad suture with frontonasal; frontoparietals separated, quadrangular, touching two supraoculars; interparietal larger than frontoparietals, broadly in contact with frontal; parietals rather narrow, elongate, enclosing interparietal; a pair of nuchals, wider than long.

Five supralabials, first largest, thickened, equally as long as nasals but extending a little farther posteriorly; second labial as high as first, touching loreal; a small preocular; third labial below eye; one postsubocular; two supraciliaries, three supraoculars; two anterior temporals, upper touching parietal, three secondaries, upper touching parietal and nuchal.

On sides of neck a vertical depression marking back part of head. Mental large, thickened, somewhat wider than long, with a longer labial contact than that of rostral; rostral projecting beyond mouth about a third the length of mental; four infralabials, first thickened; first chinshields separated by one scale, second by three scales, third pair by five scales.

Body scales in 18 rows about middle of body, 22 and 20 about anterior part; a pair of enlarged preanals flanked by a smaller scale on each side; scales from parietal to above vent, 125; subcaudals, 124, the last one an enlarged rounded scale.

Color in life: Slightly pinkish fawn above; lower part of rostral cream, clouded with darker above except at rim; nasals clouded; head dark with a T-shaped lighter area on frontal and frontonasal; two broad dark stripes begin on parietals and continue along back, narrowing, separated by two whole and two half scalerows; on tail edges of lines are diffuse and minutely broken; the median scale-

rows have minute blackish punctations and a few scattered punctations appear on the dorsolateral fawn rows; a short whitish line on temporal region; a blackish stripe borders the fawn from second labial, less intense anteriorly. This merges into dark brownish coloration of venter where all scales have some lighter areas; lateral dark line connected with narrow dorsolateral dark line just back of head. The preanal scales are partly grayish white.

Measurements in mm. (from Nos. 33104 and 33243, respectively): Snout to vent, 82, 92; tail, 71, 64; head, width, 3.2, 3.6; head, length, 6.1, 6.7; width of body, 3.85, 4; width of tail at base, 3.4; 3.3.

Distribution: The species originally was known from the two type specimens sent from Siam in 1883. The exact locality however was not known. This series represents the first definite localities. Bang Saen is a few kilometers south of Ang Hin in the same province, both localities being on the seacoast of the Gulf of Siam.

Remarks: A second specimen taken at the same exact spot as the described specimen at a later date, has the body and head somewhat lighter; the rostral, nasals, and first labials show but slight clouding and there is less dark pigment on the head. The dark lines on the back are less strongly marked, growing still fainter on the tail and the stripes on the sides are almost white. There is a faint powdering of brown on the venter and subcaudal regions. The tail is bluntly rounded and at the extreme tip it is almost as wide as the head. This is normal. The color above is light to the tip, while below the dark color of the ventrolateral lines unite to make the underside of the tip blackish. This is preceded by an indefinite white spot. This specimen was about four inches underground and was inadvertently severed while digging after another lizard (*Riopa*).

Specimens collected at Bang Saen, Chon Buri Apr. 15 and 18, 1958, were kept alive. On Apr. 21 one recently born young specimen was discovered in the vivarium. The other females containing embryos were examined. The young ones differed in degree of development.

Specimens taken at Bang Saen were in sandy soil in a coconut grove. When uncovered by digging about in a rotting coconut trunk or stump the specimens disappeared in the sand with alacrity seemingly by "swimming" in the sandy soil. They were not uncommon.

Genus *ISOPACHYS* Lönnberg

Isopachys Lönnberg, Kungl. Sven. Vet. Akad. Handl., Stockholm, Bd. 55, 1916, no. 4, p. 10, text figs. 2-6 (type *Isopachys gyldenstolpei*).

Palatine bones in contact mesially; maxillary teeth conical; no pterygoid teeth; eye small, closed, greatly reduced, the lower lid only slightly movable; nostril in anterior part of nasal; no supranasals, prefrontals or frontonasal; frontoparietal divided, the scales separated by an interparietal; limbless with at least a vestige of pelvic girdle present.

Only one species is known. It is endemic in Thailand, and presumably it is confined to a relatively small territory in the upper part of peninsular Thailand.

Isopachys gyldenstolpei Lönnberg

FIG. 98

Isopachys gyldenstolpei Lönnberg, Kungl. Sven. Vet.-Akad. Handl., Bd. 55, 1916, no. 4, p. 10, text figs. 2-6 (type-locality, Koh Lak, Prachuap Khiri Khan).

Ophioscincus gyldenstolpei: M. Smith, The fauna of British India, including Ceylon and Burma: Reptilia and Amphibia, vol. 2, Sauria; 1935, pp. 335-336, fig. 75.

Diagnosis: Snout broadened somewhat, much depressed, with a slightly angular edge, projecting forward beyond lower jaw; rostral large; nasals in contact; frontal very large, seven-sided; no supranasals; no prefrontals; no frontonasal; frontoparietals separated; the frontal and interparietal forming a suture; parietals relatively narrow, elongate, diagonal, forming a suture behind interparietal; rostral, mental, first supralabials, first infralabials and nasals much thickened, differing in color from rest of head.

Description of species (from No. 600 Hua Hin, Prachuap Khiri Khan, Thailand): Rostral rather large forming a flattened cap on snout extending forward beyond lower jaw, the posterior part forming an angle dorsally, laterally extending farther back than nostril; nasals very large, their sides curving rather than angular, forming a median suture equal to two thirds of their length; frontal as broad as long, its length much greater than its distance from nuchal or from tip of snout, in contact with interparietal; two frontoparietals, rectangular, widely separated by interparietal; parietals elongated, diagonally placed, forming a suture behind the interparietal; a pair of nuchals, left broken into two scales; a large

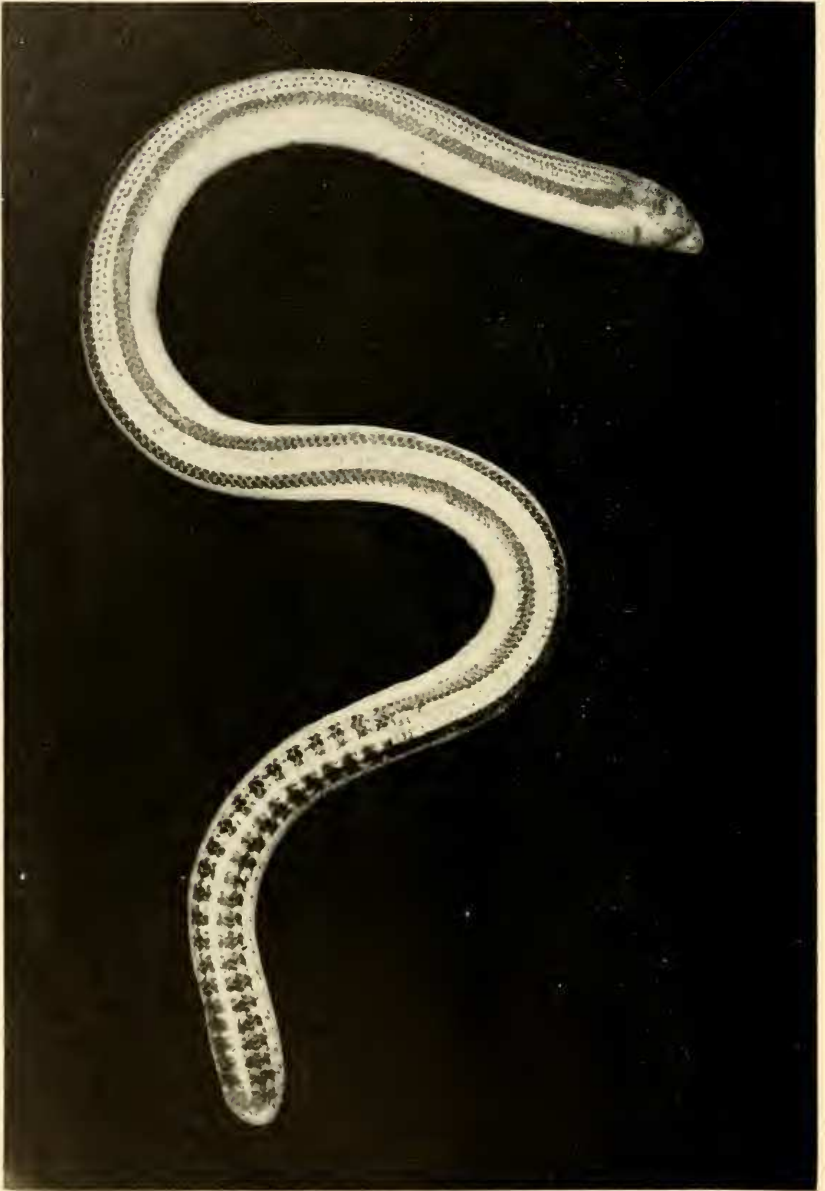


FIG. 98.—*Isopachys gyldenstolpei* Lönnberg. No. 600, Hua Hin, Prachuap Khiri Khan, Thailand. Actual total length, 250; snout to vent, 179 mm.

elongate secondary temporal borders parietal, upper primary temporal touches it also, but not lower; first supralabial very large extending farther back than nasals, followed by three supralabials, second, below eye, smallest; three supraoculars, median largest (not as shown in Smith's [1935] figure); two preoculars, one behind other (loreal^s?); one or two supraciliaries; a single opaque scale serves as a lower eyelid and presumably is slightly movable (seen in life); the interpretation of three other small scales below and behind the eye is in doubt. Mental very large with a labial border more than a half greater than that of rostral; an enlarged triangular first infralabial followed by three others; no azygos postmental; first pair of chinshields touch first infralabials, separated from one another by a small median scale; second pair not well differentiated, separated by several scales that are larger than adjoining scales, and also separated from infralabials. No ear-opening. A constriction behind head clearly defined laterally.

Scales smooth, 29 to 31 around neck; 24 rows at midbody, and 19 rows around the middle of the complete tail. Two median preanals distinctly enlarged but thin; lateral preanals somewhat modified; subcaudal count 85; proximally median row larger than adjoining scales, but more distally adjoining rows are equally widened.

Tail relatively short about one fourth of total length, terminating bluntly; tail at tip only slightly narrower than greatest body-width.

Color in life: Above, ground color pale yellow; dark lavender dots forming two dotted rows on the two median scalerows; a broad dorsolateral chocolate-brown stripe covering two whole and adjoining half rows of scales, these stripes tending to join on occiput; on tail, each stripe replaced by a series of indefinitely edged, quadrangular dark spots, separated by a narrow yellow line, the two rows separated by a yellowish line; side yellow; upper scalerows may have some minute dark dots; ten ventral scalerows light lavender brown, the edges slightly ragged, the stripe narrower on underside of neck. Top row of head yellow-brown with some darker marking about eye and a vertical mark on side of head.

Variation: The variation in scale counts around the middle of the body is 24 to 28 (*vide* M. Smith 1935). All specimens available to me have 24. Scales around the neck vary from 29 to 31, while around the middle of the tail the number is 19. Only one specimen has a complete tail and in this the subcaudal count is 85.

Variation noted in dorsal coloration is as follows: in Nos. 599 ♀ and 602 ♀ the two median rows of dots are moved outwards a

Measurements in mm. of *Isopachys gyldenstolpei*

NUMBER	599	601	600	602
Snout to vent.....	182	181	179	167
Tail.....	28*	61*	71	26
Total length.....	210	242	250	193
Diameter of body.....	9	10	9.9	9.8
Diameter of tail.....	7	9	8	8.8
Width of head.....	8	8.3	9	7.8
Length of head.....	12	11.3	12.3	9.9

* Regenerated.

little leaving an immaculate median line, the dots themselves tending to be attached to the dorsolateral stripe. In No. 601 the dots are minute, scattered, and do not form distinguishable lines.

In the No. 599 the dorsolateral lines fail to coalesce on the occiput; surrounding a light spot in this area there is a fine tracery of lavender. There are scattered lavender flecks on the head. The dorsolateral lines continue on the tail as a series of spots that tend to coalesce and form transverse bars divided medially; part of the tail is regenerated. In No. 601 there are 22 transverse bars, while the regenerated part of the tail shows three or four more indefinite bars. The sides of the tail may have a fine powdering of lavender.

Distribution: The species has been known previously from three specimens taken at Kho Lak, the type-locality, and Hua Hin in Prachuap Khiri Kalm. My four specimens are from the latter locality.

Remarks: *Isopachys gyldenstolpei* is a burrowing species with a cylindrical body. It has been found under logs. My specimens were found some inches underground in soft dry earth. Two, a male and a female, were taken together at the same time. The female contains five embryos.

When picked up the lizard usually remains very quiet with little or no movement, and no struggling to escape. The eye is not opened but I discerned some movement of the lower lid which seems to consist of a single scale. The five scales anteriormost on the upper jaw, and three on the lower, form a thickened cap. These presumably have developed in response to the burrowing habit. The color fades quickly in alcohol and the ground color becomes nearly ivory-white.

Associated with the pair (in the same area, two x two foot square) there were three specimens of *Ophioscincus anguinoides*, three

Typhlops braminus and two *Riopa bowringi*. A third specimen of *Isopachys gyldenstolpei* was found the following morning at the same place. Such a concentration of species has not been found heretofore. I could find no reason for this as there was no visible food supply, no especial cover such as logs or trash. However, the earth was dusty, soft, and offered little resistance in burrowing, and may formerly have been the site of a pile of rotting grass.

It seems to me that Lönnberg's genus *Isopachys* is distinct from other scincoid genera and should not be placed in the synonymy of *Ophioscincus*. It would appear that osteoderms in this genus differ from those in many skinks in that "the osteoderms are greatly thinned, so that they offer no obstacle to the passage of Röntgen-rays." This with the absence of prefrontals and frontonasal would seem to suffice to differentiate the genus from *Ophioscincus*. M. Smith calls attention to the condition of the palatine bones, originally described as separated, actually they are normally in contact and the apparent separation was due to a skull injury.

The species lives in loose soil where it burrows with ease.

FAMILY DIBAMIDAE Boulenger

Tongue short, bifid posteriorly, pointed, undivided in front, covered with curved lamellae and plicae. Teeth small, pointed, hooked, none on palate; no cranial arches; no infraorbital foramen; fore and hind limbs absent in female, the legs represented in male by a pair of flaps on each side of anal vent. Body vermiform covered with cycloid scales above and below; no osteoderms. Eyes concealed under the skin. No ear-opening; preanal pores one or two.

The family contains only one recognized genus, *Dibamus*. Some five or six forms have been described, and others now in various museums await description.

A single Thai species is known from Pattani province in southern Thailand.

Genus DIBAMUS Duméril and Bibron

Dibamus Duméril and Bibron, *Erpétologie générale* . . . , vol. 5, 1839, p. 833 (type of genus *Dibamus novae-guineae*).

Diagnosis: (See family characters); snout may be covered by a large rostral and a large labial on each side or these may be fused into a single shield; nostril in rostral with a straight horizontal suture behind it. Male with legs represented by two flaplike rudiments; no legs in female.

Dibamus alfredi Taylor

FIG. 99

Dibamus alfredi * Taylor, Univ. Kansas Sci. Bull., vol. 43, 1962, pp. 246-248, fig. 13 (type-locality, Na Pradoo, Pattani, southern Thailand).

Diagnosis: Snout subconical covered by a large rostral, with an entrant suture from ocular at about level of eye, extending forward but not reaching to level of nostril; frontal distinctly smaller than interparietal; 20 or 21 scalerows around body; four preanal pores in male, two in female. Transverse scalerows, 219-230.

Description of species (from type): Rostral large, rounded anteriorly, and in profile; nostrils lateral, pierced in rostral somewhat back of anteriormost point; snout projecting beyond mouth; posterior border of rostral emarginate; a small median frontal twice as wide as long, somewhat lens-shaped, bordered behind by a distinctly larger interparietal; latter bordered behind by five scales, shaped somewhat like regular body scales but distinctly larger; an ocular plate borders frontal and interparietal; eye covered by an ocular scale, but visible in outer anterior part of scale; a supralabial scale borders ocular laterally. Anterior to ocular at about level of eye an entrant suture in rostral extending forward, failing to reach as far forward as vertical level of nostril by a third of length of suture. A large infralabial on each side separated by a smaller trapezoidal mental.

Body scales smooth, subcycloid, or subhexagonal; 24 scalerows around back part of head; 22 on neck, 20 around middle of body. 20 preceding vent, and 20 around tail; tail rather short, blunt at tip, not ending in a spine. Legs flattened on ventral surface, which is covered with three scales at base followed by three pairs of scales and an elongate terminal scale; on dorsal surface, legs covered by about 18 scales; two preanal pores on each side; covered by a somewhat enlarged scale through which the two elongate pores are more or less visible. Triangular preanal area between folded limbs occupied by two transverse rows of three scales each, and an elongate terminal scale, its posterior half free. No ear-opening; eyes dimly visible through ocular.

Color in life: Generally violet to purplish brown, not or scarcely lighter below on ventral surfaces; underside of snout, a large area about nostril, sides of head, and anterior part of chin, cream to ivory-white. Preanal scales and dorsal surface of limbs white. On ventral surface of type, about 50 scattered ivory-white scales.

* Named for Mr. Eric Alfred of the Raffles Museum, Singapore.



FIG. 99.—*Dibamus alfredi* Taylor. No. 1385. Na Pradoo, Pattani, Thailand. Actual total length, 111.2 mm.

Measurements in mm. (Nos. 1386 ♀, 1385 ♂, 3174 ♂, and 3175 ♀, respectively): Snout to vent, 98, 94, 92, 99; tail, 15.6, 17.2, 17, 15; width of head, 3.1, 3.2, 3.2, 3.1; width of body, 4, 3.4, 3.7, 3.9; length of leg, —, 3, 3, —.

Variation: The female taken with the type agrees in most characters. The legs are absent. The ocular is bordered behind by two "postoculars"; 20 or 21 scalerows around middle of body, while there are but 18 around middle of tail. The male type has about 230 transverse scalerows; in this female there are 178 transverse scalerows on body, and 41 on tail, totaling 219; each of the two other specimens has 227 transverse rows; however, the body rows are 172 ♂ and 181, on the tails, 55 and 46.

At the base of the anal flap, there is a pair of large scales separated by a smaller scale; behind this is a transverse series of five scales followed by a transverse series of three bordering the vent. In the females I find only a single preanal pore present on each side. The ivory-colored scales on the venter are absent.

Distribution: B. M. No. 1903.4, 13.69, an egg containing a young specimen of a *Dibamus* discovered on Bukit Besar, Pattani, by Robinson (1903), and reported by Boulenger, is in the British Museum. I have examined this embryonic specimen but the scale sutures on the head are as yet not clearly discernible. It is to be presumed that it is the same species since the egg was found in the general vicinity where my adults were taken.

Tweedie, 1950, has reported a single specimen of *Dibamus* (as *novaguineae*), 114 mm. long from Gua Madu, Gua Musang, Kelantan, Malaya, which may belong to this species.

Remarks: *Dibamus alfredi* seems to differ from a related species *Typhloscincus nicobaricus* Steindachner from the Nicobar Islands, as follows: there are 20 or 21 scalerows instead of "circa" 23; the entrant suture is, from the ocular; the rostral fails to reach the nostril (separated by one third of the length of the suture instead of entering the nostril); the rostral does not form a sharp angle posterolaterally, but is blunt; the labial scale is below (not behind) level of ocular; the interparietal is smaller and two small parietals on side of interparietal are not differentiated as shown in the Steindachner figure. (Novara Exped. Zool. Reptilien, Steindachner, pl. III, fig. 8 but not shown in fig. on p. 94).

The type of *Typhloscincus nicobaricus* could not be found at the Vienna Museum where it is presumed to have been deposited by Dr. Steindachner (*loc. cit.*) and the comparisons have been made with the type description and figures on plate 3, and figures on p. 94.

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